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INM

INTEGRATED NOISE MODEL VERSION 2

PROGRAMMER'S GUIDE

(15) DOT-PPA-FA-865

(10) Thomas /Connor
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16. Abstract

This document contains information on the procedures to implement the Integrated Noise Model (INM), Version 2 on to a computer system. The INM is a collection of computer programs which can calculate the aircraft noise environment in the vicinity of an airport. The INM is available from the FAA in the form of a magnetic tape.

INM Version 2 supersedes Version 1 which was released in January 1978. This document replaces "FAA Integrated Noise Model, Version 1, Computer Installation Instructions" (Report No. FAA-EQ-78-03).

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1.0 INTRODUCTION

A set of computer programs has been generated for the Federal Aviation Administration for the computation of noise exposure values due to aircraft operations around airports. The collection of programs is called the Integrated Noise Model (INM). The INM will compute noise exposure values for the following noise metrics: Noise Exposure Forecast (NEF); Day-Night Average Sound Level (Ldn); Community Noise Equivalent Level (CNEL); Equivalent Sound Level (Leq); and the Time Above A-weighted Sound Levels (TA).

The INM is comprised of the following programs which operate separetely:

- o The Contour Analysis
- o The Grid Analysis Model
- o The Contour Plotting Packages
- o Data Base Translator
- o Data Base Formatter Listing Generator

While the contour analysis and grid analysis models operate independently, they share the subroutines which read the input data and perform single-event noise calculations. The contour plotting package uses as its primary input the definition for contour point locations which are output by the contour analysis models.

These programs are written in the FORTRAN IV language. An effort has been made to conform to the current ANSI standards, in order to allow for multiple installations of the INM. However, the user is cautioned that known differences from the standard exist, (see Section 3.2) and that further differences may not be documented. Version II of the INM is currently operating on CYBER 175 and CDC 6600 systems, and the plot routines are used on ZETA and CALCOMP plotters.

This manual is intended for use by computer programming personnel, familiar with the protocols of the FORTRAN programming language, who need to know the external characteristics of the Integrated Noise Model and its internal processing in order to install it on their own operating system. A more used-oriented description of the capabilities and use of the models is contained in the INM User's Guide (Version 2.4). Also available at the Federal Aviation Administration (FAA) is extensive prelimimary documentation on other model options, the algorithms used in the models and individual subroutine characteristics. It is FAA's intention to organize and publish this material in further supplementary manuals.

Requests for information, source code tapes, manuals, or other assistance should be sent to:

Federal Aviation Administration
Office of Environment and Energy, AEE-120
800 Independence Avenue, S.W.
Washington, D.C. 20591

or telephone (202) 426-3396. Manuals and tapes may be available at cost.

2.0 TAPE CHARACTERISTICS

The INM release tape has the following characteristics:

9-track

800 RPI

odd parity

EBCDIC

Unlabeled

The first 14 files are blocked using 39, 80-character card images per block. The last block will, if necessary, be padded with nulls to fill out 3120 characters. Files 15-19 are blocked using 25, 132-character line images per block, the last block padded to fill out 3300 characters.

Files 1 through 8 are FORTRAN IV source code

Files 9 through 14 contain input data

Files 15 through 19 contain sample output

File 1: VERSUN6, the Contour Analysis main routine

File 2: GRID5, the Grid Analysis main routine

File 3: All subroutines called by VERSUN6 or GRID5

File 4: The CALCOMP - compatible contour plotting routine

File 5: The ZETA - compatible contour plotting routine

File 6: The database translator program

File 7: The database formatted listing generator

File 8: Input Module

File 9: The database

File 10: Example input data for the Contour Analysis, Case 1

File 11: Example input data for the Contour Analysis, Case 2

File 12: Example input data for the Grid Analysis, Case 3

File 13: Example input data for the Grid Analysis, Case 4

File 14: Example input data for the Grid Analysis, Case 5

File 15: Output from Case 1

File 16: Output from Case 2

File 17: Output from Case 3

File 18: Output from Case 4

File 19: Output from Case 5

3.0 INSTALLATION INSTRUCTIONS

The following instructions are intended to serve as a guideline to the conversion of the Integrated Noise Model as supplied by FAA to another machine and operating system. These are not intended to dictate the precise nature of the installation, as each installation is system-dependent. All references made to the CDC 6600 and its operating system are by way of example only and should not be construed as endorsements of those products.

3.1 INSTALLATION PROCEDURES

(a) Set up the appropriate user name, charge number, or other accounting information to validate the run.

(b) Log the tape supplied by FAA into the system.

(c) Attempt to read the tape

(d) Verify that the tape characteristics match the documented characteristics. If not, try other characteristics until the tape can be read. As a last resort, contact FAA.

(e) Copy the files from tape to disk (optional; disk files are more expensive but more convenient than tape).

(f) Get listings or dumps of at least part of every file on the tape, and verify that all files match their documentation and that all documented routines and

files are present. See Section 7 for the list of programs and subroutines in the model.

(g) Put the source code for each subroutine into a separate section of a library, so that each can be accessed and compiled separately. On the CDC 6600, use the system utility UPDATE.

(h) Check on known compatibility problems documented in Section 3.2. If necessary, revise the machine-dependent routines CLOCK, CLOCKT, DATE, EXIT, SKFIL, ZERO.

(i) Compile each program and subroutine using the appropriate FORTRAN compiler. Correct any fatal errors and recompile.

(j) Examine the routines for obvious incompatibilities between systems. Look for data declarations, subroutine calls, use of Hollerith strings, printer control characters, external and system routines, and non-ANSI code. Correct any incompatibilities found and recompile until the routines are error-free.

(k) Put the relocatable code into a library so that each subroutine is accessible separately, thus facilitating correction. On the CDC 6600, use EDITLIB for the relocatable code.

(l) Try to load each program and its associated subroutine without executing.

(m) If a program is longer than the available memory, restructure the program into overlays.

(n) Check all loader maps for errors and unsatisfied externals.

(o) Compile the data translator program. When compilation is successful, load and execute the program, creating an unformatted version of the system data base. See Chapter 4 for a more detailed discussion.

(p) Get a listing of the data supplied for a test run. Check it against the format required by the model, as documented in the Basic User's Guide.

(q) Execute the programs using the test data, debugging as necessary until the tables output from the model match the sample output provided in files 14-18 on the tape. Note that all calculations should match the sample output exactly. If not, check the compiler's rounding conventions.

(r) Set up whatever programs or procedures are necessary for converting the CALCOMP plotters file into a file compatible with the available graphics devices. Verify that the test plots match the sample plots. The programs currently run on ZETA or CALCOMP plotters.

(s) Set up the final version of the relocatable code in a user library or as a file in whatever overlay structure

was decided upon. Save the new version of the source code on tape or other backup storage medium.

(t) Document the sequence of commands needed to run the model and append it to the Basic User's Guide and this Installation manual. Include information on the model's space and time requirements, cost, turnaround time, and system-dependent limitations.

3.2 CONVERSION PROBLEMS

Item No.	Item Desciption	Item Category
1	BLOCK DATA Initialization	IBM Restricted
2	Boolean Operations	Differences
3	Call Statement Parameters	Extensions
4	Data Initialization	IBM Restricted
5	ENTRY	Differences
6	EQUIVALENCE	Machine Dependent
7	Format: A	CDC Extension
8	Hollerith Strings	IBM Restricted
9	Hollerith Variables	IBM Restricted
10	Identifier Names	CDC Extension
11	Octal Constants	Non-IBM
12	Non-ANSI Subroutines	Differences
13	PROGRAM Statement	Non-IBM

14	RETURN I	Differences
15	Rounding	Differences
16	User-Supplied Subroutines	Machine Dependent

EXPLANATION

1. Some programming languages conform to the rule that common block variables may only be initialized in BLOCK DATA subroutines. The code may contain data initialization of such variables in other subroutines.
2. The model uses the Boolean operations AND and OR to extract characters from data words. It uses masks stored in array MASK and initialized in BLKDAT subroutine. These operations should be machine independent, provided the masks are converted properly. See No. 12 below.
3. IBM FORTRAN permits passing a statement number, N, by prefixing an ampersand:

```
CALL SUB (A,B,&10,C,&20)
```

CDC FTN FORTRAN uses the RETURNS list:

```
CALL SUB(A,B,C) RETURNS (10,20)
```

This problem will occur in subroutine PFILE in the CONTUR program.

4. Some common block variables may be initialized in DATA statements outside of BLOCK DATA subprograms. There

may be common blocks whose names begin with numbers or which are seven characters in length.

5. There are several subroutines with alternate entry points. These routines should be checked to see that local conventions for passing parameters are observed. The model passes the same parameters to alternate and main entry points.

6. EQUIVALENCE is the scourge of conversion programming efforts, since machine dependent code is often involved. Extreme care must to taken to thoroughly understand the word boundary alignments which the equivalence forces. An effort has been made to insure that all equivalences observe ANSI standards.

7. Formats of A6 or A10 are used in reading and writing data, building titles, and building variable formats (See routines HEADER and GRID). In CDC FORTRAN, such formats read data into a single word.

8. Hollerith strings may not be used in IBM FORTRAN assignment statements, but may appear in the model.

9. Care must be taken to declare Hollerith variables long enough to hold the required string. In particular, check that the arrays used in HEADER to hold the title information are the proper size and that the building process assigns these variables appropriately.

10. There may be seven-character names in the model, although some care has been taken to use only six-character names.

11. Octal constants may have to be converted to hexadecimal if a conversion to IBM is done. Also, the length of the constants used must be adjusted in conversion to any non-CDC machine. These constants are used in the Boolean operations discussed in No.2 above. There are 21 octal constants in array MASK, which is initialized in Block Data subprogram BLKDAT. The length of the first 17 constants may be adjusted by subtracting (or adding) zeroes on the right until the constant will fill one word on the machine. For the last four words, adjust with zeroes on the left. This adjustment will work as long as the machine has a word length of at least 23 bits. If the word length is smaller, serious conversion problems will result.

12. The INM assumes that system routines exist to provide the data (DATE), the time of day (CLOCK), and to end the program (EXIT).

13. PROGRAM is strictly a CDC convention, used to identify the main program name, and indicate the logical unit numbers of all input and output files used during program execution.

14. CDC method of returning to a statement number passed through RETURNS. IBM uses *. This occurs in subroutine PFILE in program CONTUR.

15. There are two system dependent subroutines which the user must supply: SKPP (with entry points SKPPFF, SKPPFL, SKPPBL, SKPPBF) and SKPP1 (with entry point SKPPFX). Called by routines SKFIL and SKREC, they are used to skip forward and backward on both files and records. CDC 6600 assembly language which interfaces with the Record Manager utility is provided.

4.0 DATA BASE AND TRANSLATOR

Standard aircraft performance and noise information is stored in the INM Data Base. The contents of this data base are presented in the Data Base Report (Report No. FAA-EE-79-11). This data is supplied by the FAA, along with the INM, in the form of a FORTRAN-readable formatted data file. However, the INM programs, for reasons of both efficiency and security, read an unformatted version of this data file. It is the installer's-responsibility to create this unformatted data file. To this end, FAA is supplying a FORTRAN data translator program, which will read the formatted data base from magnetic tape and will create the appropriate file on disk.

The program expects that the formatted data base will be input on logical unit number 3, and it writes the unformatted version to logical unit 4. The unformatted data base is intended to reside on disk; it should contain fewer than 7000 words, so that storage costs will be minimal. It is recommended that the translator program and the formatted data base be kept on a back-up storage medium, such as tape or cards, as there will be little need for them once the unformatted data base is installed.

The formatted data base is used by the INM Selective Data Base Printing Program (INMPRI). The formatted data base is input on logical unit 4 (OLDDAT). The print control cards (see Section 2 of Data Base #5 Report, Volume 1) are input on logical unit 5 and the program writes the data base listing to logical unit 6. Like the data base translator, the data base listing generator is written in ANSI FORTRAN.

5.0 PROGRAM DESCRIPTION

The Integrated Noise Model provides two general capabilities: The grid analysis program predicts noise values at user specified locations and the contour analysis program produces the coordinates of points defining a contour of a specified noise level. To create a contour map; i.e., read the coordinates from the contour analysis output and plot them, one of two plotting routines may be used. The two programs provided on the INM tape are compatible with ZETA and CALCOMP hardware, respectively.

The above programs are written in CDC FORTRAN IV with two COMPASS 3.0 assembly language subroutines. These subroutines use the CDC Record Manager for file positioning. The above programs use the following I/O units in the following manner:

Unit	Purpose
2	Output from the contour analysis to be input to a plotting routine
3	Scratch file used for storing flight information
5	Input data file (INPUT)
6	Listable output (OUTPUT - except in ZETA routine)

Unit	Purpose
7	Database
8	Plotfile output from CALCOMP routine

The ZETA routine writes the plotfile to OUTPUT.

The database is provided in listable form (File 8 on the tape). For reasons of efficiency, however, the INM reads the database from a binary file. This file is created using the database translator program (File 6). Here unit 3 is used to input the database as it appears on the tape and unit 4 is for the binary output file.

To produce a labeled report of the contents of the database, the database, formatted listing generator (File 7) is provided in the tape. With it, one may request individual data sets or all data sets associated with an aircraft type. Input to this program includes the database as it appears on the tape on unit 4 and a set of user commands on unit 5. (See Appendix of User's Guide.) The output listing is produced on unit 6.

6.0 FUNCTIONAL AND LINKAGE DIAGRAMS

Figures 6.0-1 through 6.0-5 depict functional and linkage diagrams.

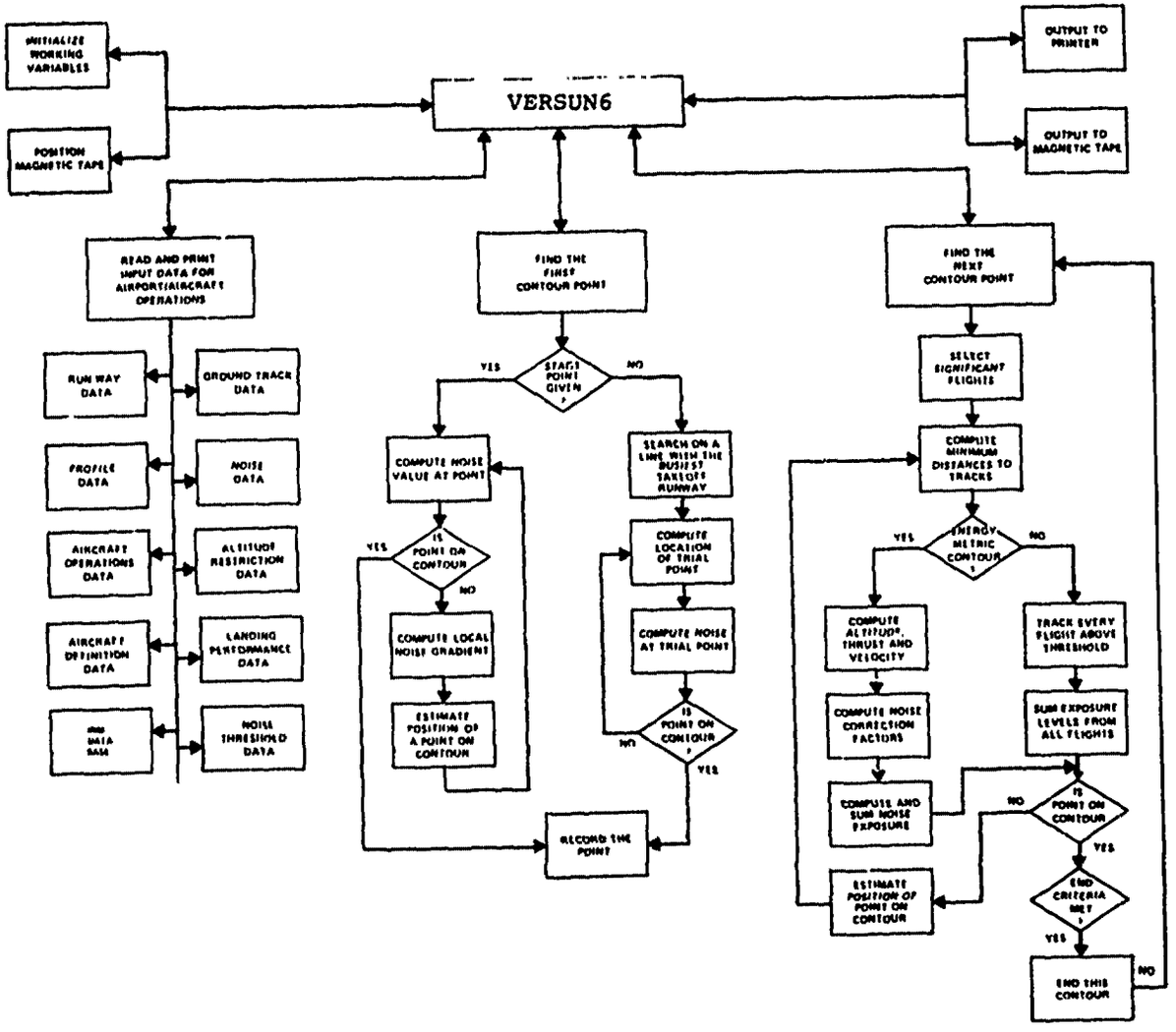

FIGURE 6.0-1. FUNCTIONAL FLOW DIAGRAM FOR THE CONTOUR ANALYSIS MODEL

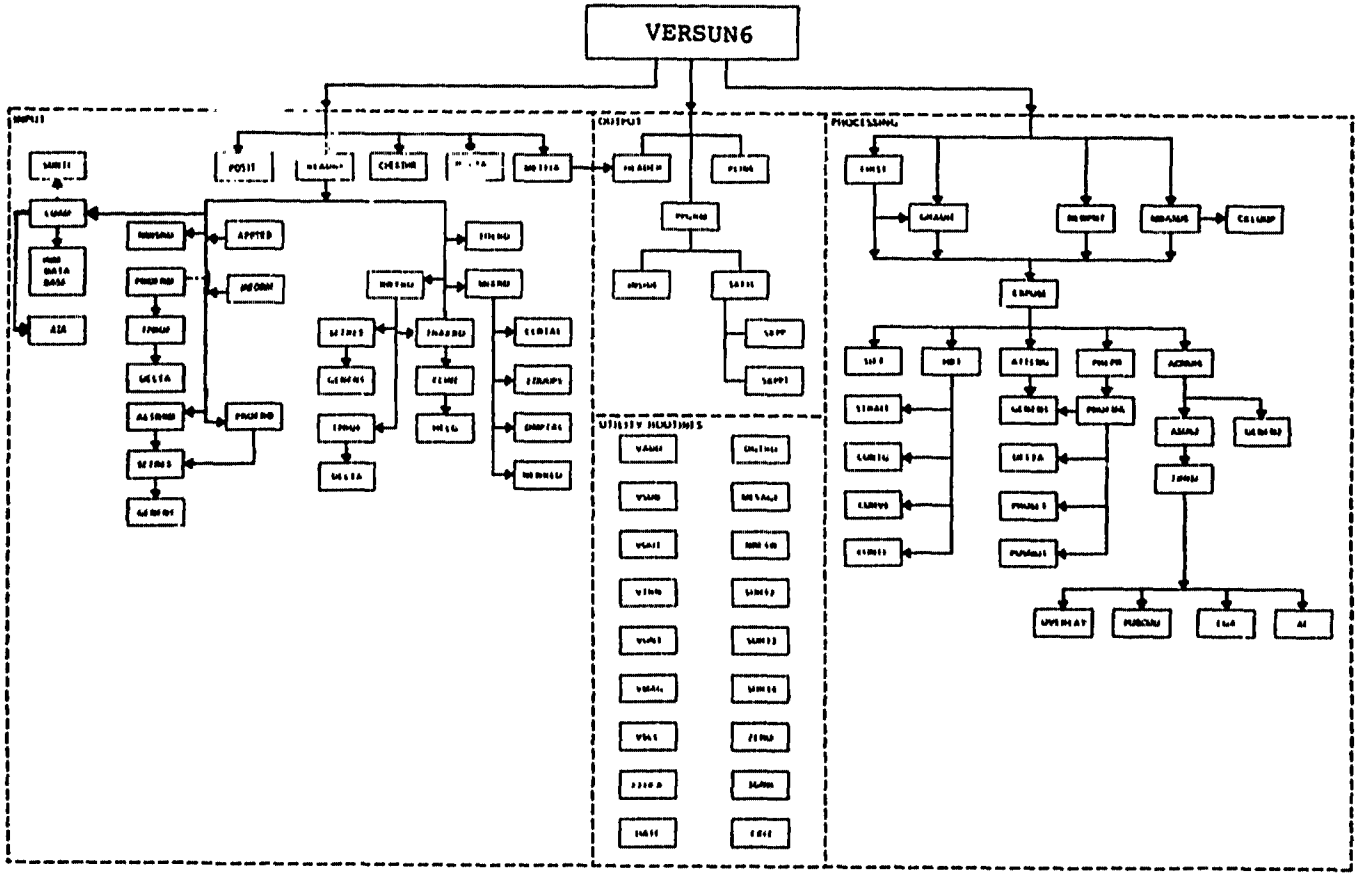

FIGURE 6.0-2. SUBROUTINE LINKAGES FOR THE CONTOUR ANALYSIS MODEL

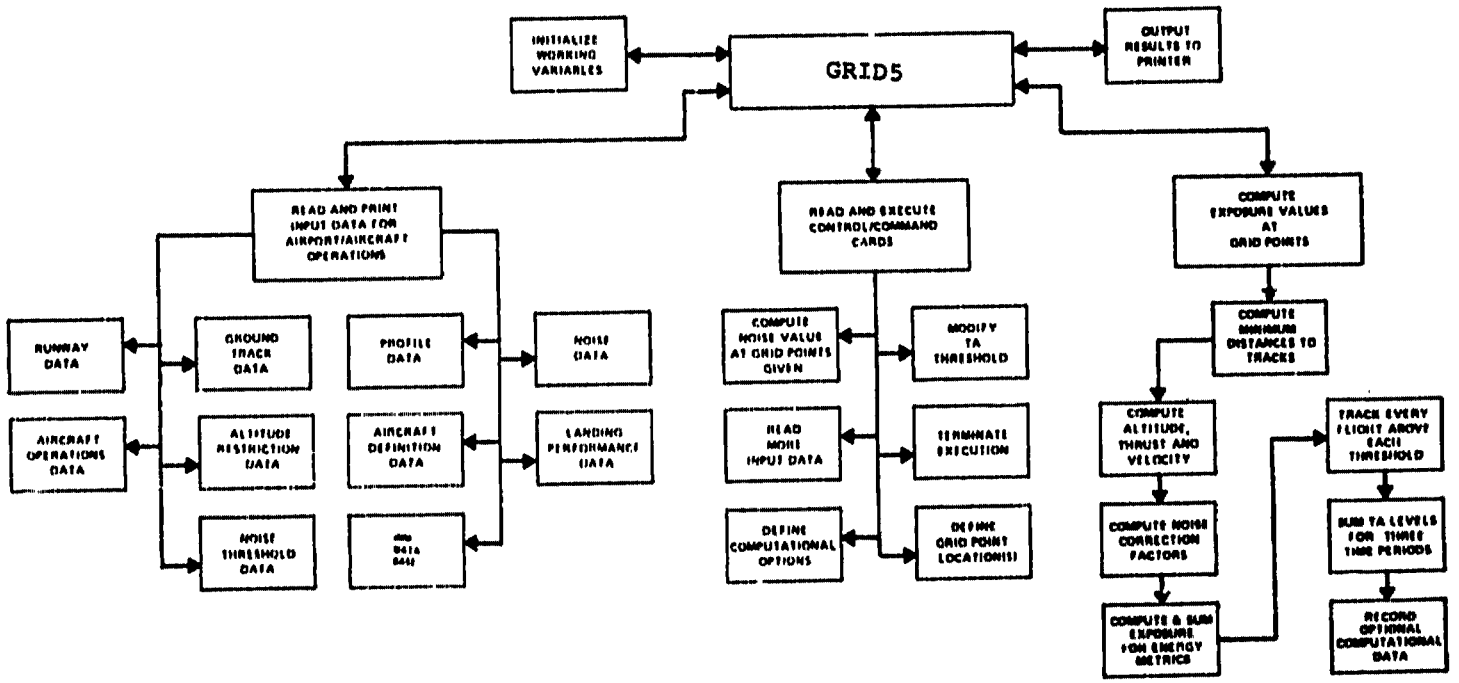

FIGURE 6.0-3. FUNCTIONAL FLOW DIAGRAM FOR THE GRID ANALYSIS MODEL

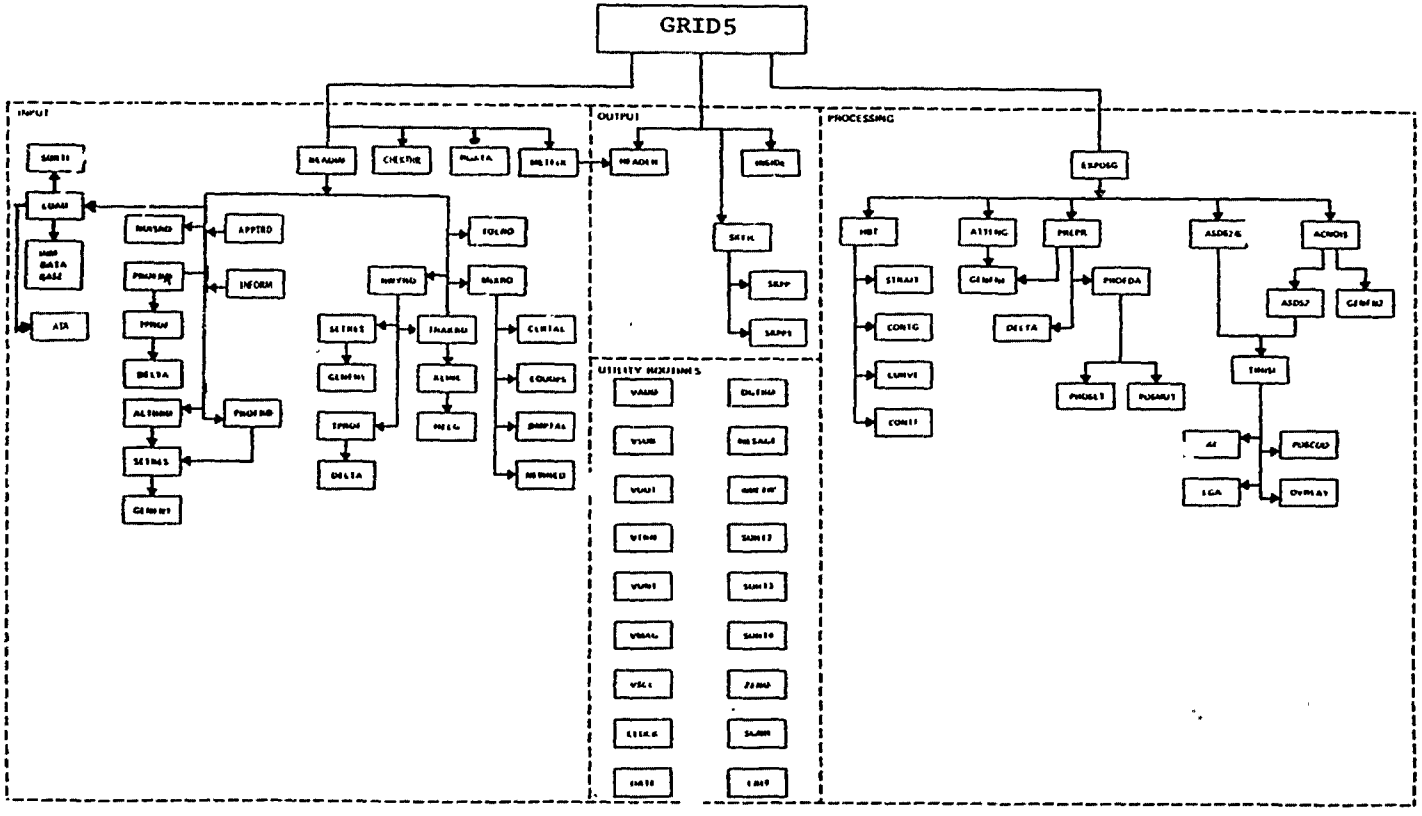

FIGURE 6.0-4. SUBROUTINE LINKAGES FOR THE GRID ANALYSIS MODEL

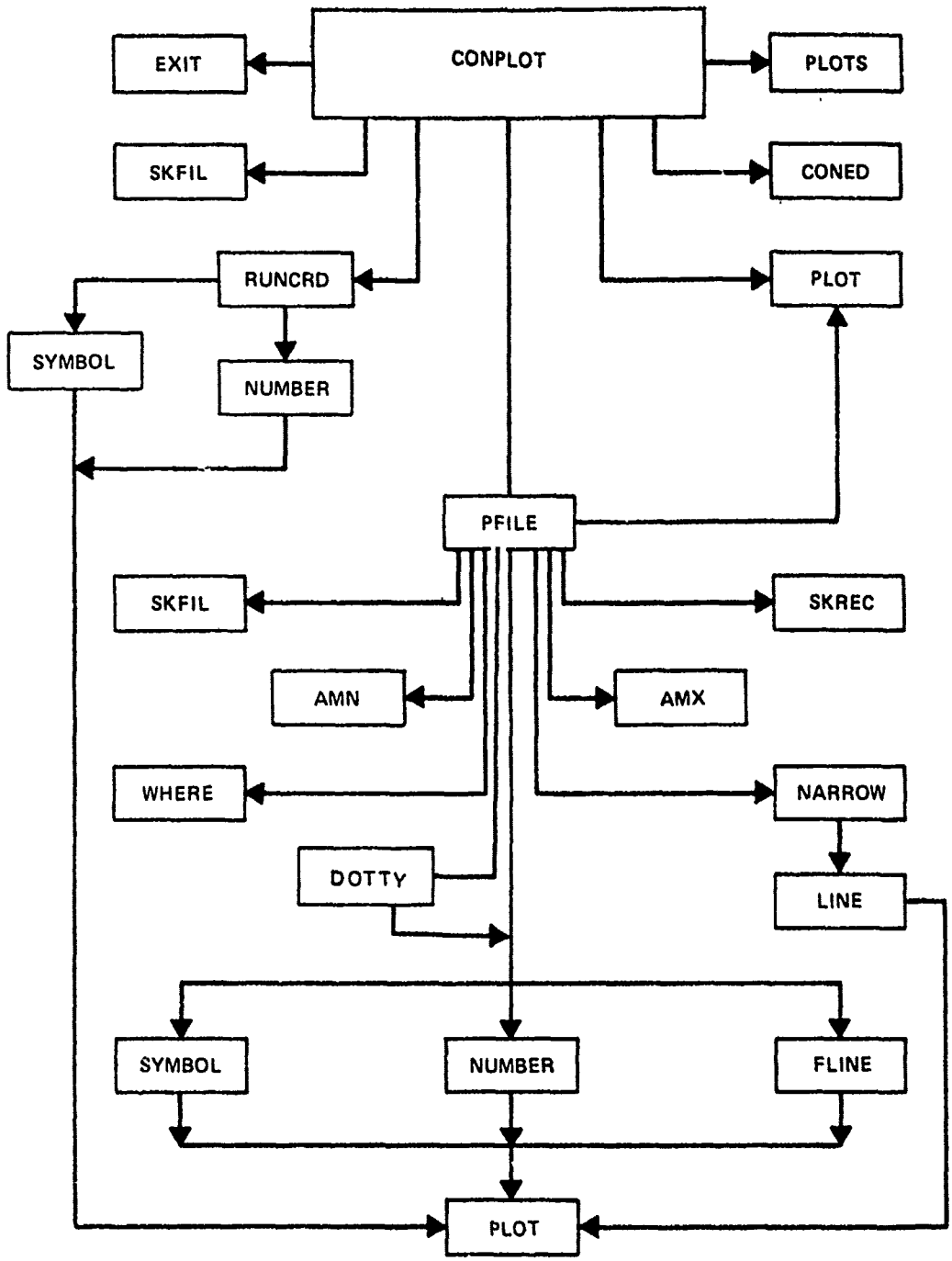

FIGURE 6.0-5. SUBROUTINE LINKAGES FOR THE CONTOUR PLOTTING SYSTEM

7.0 SUBROUTINE DESCRIPTIONS

This section contains a brief description of each of the routines used in the three programs of the Integrated Noise Model. These descriptions will include each routine's purpose, call sequence, entry points, returns, external routines called input, and output. They are presented in the following order:

NOISE main program

GRID main program

Subroutines called by NOISE and GRID, listed alphabetically

Main Program VERSUN 6

```
C**********************************************************
C***  NOTICE TO USERS:
C***  THE INTEGRATED NOISE MODEL IS AN OFFICIAL STANDARD
C***
C***  ANY COMPUTER PROGRAM FOR CALCULATING AIRPORT NOISE.
C***
C***  NO CHANGES, ADDITIONS, OR DELETIONS ARE AUTHORIZED TO
C***
C***  THIS SOURCE CODE EXCEPT AS AUTHORIZED BY THE
C***  FAA IN OFFICIALLY DESIGNATED REVISIONS.
C***
C***
C**********************************************************************
C     THIS IS THE INTEGRATED NOISE MODEL VERSION 01.00.000.00
C     DEAR KEY:
C  MAIN PROGRAM                          ***NOISE1***
C     THE USER IS REFERRED TO THE BLOCK FLOW
C     DIAGRAM APPEARING IN OTHER DOCUMENTATION FOR A COMPLETE
C     OVERVIEW OF SUBROUTINE CALLS.  THE SUBROUTINE CALLS
C     MADE DIRECTLY BY NOISE1 INVOLVE THE FOLLOWING
C     ROUTINES:
C     (APPROXIMATELY IN ORDER OF APPEARANCE)
C     SETF EXIT LOAD ZERO
C     PREFIX READIN CLOCK HEADER
C     FIRST PASS2DS MOVEMT UTIL
C     DIME VSUB PRINT CLOCKT
C     PADD VMAG VSCL GRADIE
C     EXPOSE
C
C     NOISE1 IS CALLED BY NO OTHER PROGRAM.
C     NOTES: SUBROUTINES FIRST, PASS2DS, AND MEASPT ACTUALLY
C     LOCATE THE CONTOUR POINTS. EXPOSE DETERMINES EXPOSURES AT THESE
C     POINTS. SEE PAGE 2-82 OF WYLE REPORT (PROGRAMMER'S MANUAL)
C     TOL IS THE ACCEPTABLE DIFFERENCE IN EXPOSURE BETWEEN TWO POINTS.
C     THE FOLLOWING SUMMARIZES LOCAL VARIABLES USED IN NOISE1.
C     AIRCRF-STORAGE FOR AIRCRAFT DEFINATION RECORDS
C     AMAXPT - USER PROVIDED MAXIMUM # OF POINTS
C      BANNER - OUTPUT TITLE  SEE DATA STATEMENT<
C     DATER - BUFFER FOR DATE
C      DEFOPS - DEFAULT OPERATIONS  SEE BLOCK DATA<
C      DEFTOL - DEFAULT CONTOUR TOLERANCE  SEE BLOCK DATA<
C      DEFTOT - DEFAULT TOTAL OPS  SEE BLOCK DATA<
C      DEFVAL - DEFAULT CONTOUR VALUE  SEE BLOCK DATA<
C      DELS - MAXIMUM ALLOWABLE DISTANCE BETWEEN CONTOUR POINTS
C     FRACTN - INTERMEDIATE RESULT IN DEFAULT STEP SIZE COMPUTATION
C      GRADV - LAST COMPUTED UNIT GRADIENT VECTOR COMPONENTS
C     I-CONTOUR INDEX OR CONTROL FLAG
C     ICMT - FIRST 6 CHARACTERS CONTROL TAPE/NOTAPE FEATURE;
C     REMAINDER IS BUFFER FOR ECHOED USER COMMENTS.  IN
C     OTHER ROUTINES IDENTICALLY NAMED ARRAYS
C     CONTAIN NUMERIC INFORMATION READ IN FROM DATA CARDS.
C     ICOUNT - FLAG FOR END OF AIRCRAFT DEFINITION RECORD
C     IDUMPC - EXECUTIVE CONTROL FLAG: 0=ERROR,-1=PLOT,+=CONTINUE
C     IDUMPR - "DUMP "  !  ASCII COMPARISON STRINGS FOR CONTROL WORDS
```

```
C     IEDIT - "EDIT "  !
C     IERROR - DUMP FLAG: 0=NO DUMP, 1=SHORT DUMP,
C     1=FULL DUMP, 2= FULL DUMP
C     IGC - ERROR FLAG FOR SUBROUTINE METFIX (NONZERO = EXIT)
C     IPAGE - PAGE COUNTER  !
C      IPSIZ - NUMBER OF CONTOURS
C     IST - CONTROL WORD (START, EDIT, DUMP, ETC) BUFFER
C     ISTOP - "END  "  !
C     ISTRT - "START"  !
C     ITAPE - "TAPE "  !
C      ITIMI - OUTPUT TITLE
C      ITR - TRACK NUMBER
C      ITRG - TRACK GROUP NUMBER
C      IT - FLIGHTS USED TO FIND LATEST CONTOUR POINT
C      IX - FLAG, SWAP POINTS AT CONTOUR CLOSURE
C     IXPOT - POINT COUNTER
C     LINCNT - LINE COUNTER !  CONTROL APPEARANCE OF PRINTED OUTPUT
C     LPLT - LAST PLOT INDICATOR
C     LPT - LAST POINT INDICATOR
C     MAXPTS - INTERNALLY COMPUTED ETC
C     METLEV- VALUE OF CURRENT NOISE EXPOSURE METRIC
C     MOP - "MOP  "  !
C     MORE - PLOT CONTROL VARIABLE
C     NPOCT - COORDINATE POINT NUMBER (ON OUTPUT PAGE)
C      NEXT - EXPOSURE AT CURRENT CONTOUR POINT
C     NOTAPE - "NOTAPE"  !
C     NPLOT - PLOTTING OPTION CONTROL FLAG
C     NPIT - CONTOUR COUNTER
C     NPT - RUNWAY NUMBER
C      NUMPE - PRIMARY METRIC NUMBER
C      NYS - THE NUMBER OF TIMES THE SUBROUTINE EXPOSE HAS BEEN CALLED
C     PCNT - PERCENT OF TOTAL NOISE REPRESENTED BY FLIGHTS INCLUDED
C     IN EXPOSURE COMPUTATION OF CURRENT CONTOUR POINT
C      POINTS - DEFAULT NUMBER OF POINTS IN CONTOUR
C      PP - COORDS OF LAST GOOD POINT ON CONTOUR
C     PPP-COORDINATES OF FIRST POINT FOUND ON CONTOUR
C     PXY- X AXIS PX  EQUIVALENCED
C      PO - FIRST GUESS AT POSITION OF NEW CONTOUR POINT, CONTAINS NEW
C                POINT ON RETURN
C     PP - AXIS PO; USERS GUESS AT FIRST POINT ON CONTOUR
C     PX- USER INPUT CONTOUR END POINT
C      QUIT - SLANT RANGE
C      STEPS - DEFAULT NUMBER OF STEPS IN CONTOUR
C     TT - ELAPSED TIME IN PROGRAM
C      TOL - CONTOUR ERROR TOLERANCE
C      TOLO - SPARE COPY OF TOL
C      WAT - CONTOUR LEVEL  DBA
C     XX - DISTANCE FROM "LAST POINT" ON CONTOUR TO STARTING POINT
C     XZZ - VECTOR DISPLACEMENT BETWEEN STARTING AND
C     ENDING CONTOUR POINTS
C
C
C
C     THE COMMON BLOCK CROSS REFERENCE LIST
C      /ATIMI/ - TIMISI,XY
C      /ASDS03/ - BLOCK DATA, ASDT, LOAD, ASD2TH, ASDS2,CKBETW
C      /ASDSHL/ - BLOCK DATA, OVRLAY, ASDT, TIMISI, LOAD, ASD2TH,
C                   TRADIF, ASDS2, ASDS2G, CKBETW
C      /BK/ - BLOCK DATA, NEXPNT, SIFT, ASDT, LOAD, TOLRD, EXPOSE, ASD2TH,
```

```
C                 PPGRM, FIRST, NWASDS, CKBETW
C      /BLKC/ - OVRLAY, TIMISI, ASDT, LOAD, ASD2TH, POSCOO, CKBETW
C      /CONST/ - BLOCK DATA, CONTP, CURVE, PREPR, ASDT, LOAD, VADD, VDOT,
C                VMAG, VSCL, VSUB, VTRN, VUNT, HBT, ASD2TH, CKBETW
C      /DEFALT/ - BLOCK DATA, ASDT, LOAD, ASD2TH, PPGRM, CKBETW
C      /DIRVTX/ - ASDT, LOAD, ASD2TH, AL, CKBETW
C      /EXAPP/ - ASDT, LOAD, ASD2TH, AI, CKBETW

C      /GRADNT/ - NEWPNT, ASDT, LOAD, ASD2TH, GRADIE, FIRST, NWASDS, CKBETW
C      /GRDBK/ - ASDT, LOAD, ASD2TH, ASDS2G, CKBETW

C      /GRDBLK/ - ASDT, LOAD, EXPOSG, EXPOSE, ASD2TH, GRADIE, ASDS2, ASDS2G,

C                 NWASDS, CKBETW

C      /GRDCNT/ - ASDT, LOAD, EXPOSG, ASD2TH, ASDS2G, CKBETW
C      /LOOPS/ - NEWPNT, ASDT, LOAD, ASD2TH, NWASDS, CKBETW
C      /METRIC/ - BLOCK DATA, ACHOIS, METFIX, MIXRD, ASDT, LOAD, HEADER,
C                EXPOSG, EXPOSE, ASD2TH, GRADIE, PPGRM, FIRST, NWASDS, CKBETW
C      /MIXDTA/ - BLOCK DATA, ASDT, LOAD, ASD2TH, ASDS2, ASDS2G, CKBETW
C      /NOISE/ - BLOCK DATA, ATTENG, ACHOIS, ASDT, LOAD, CKBETW, NOISRD,
C                ASD2TH, ASDS2, ASDS2G
C      /PROFIL/ - BLOCK DATA, SETRES, TPROF, PROFDA, PREPR, PROSET, MIXRD,
C                ASDT, LOAD, RWYRD, PROFRD, APPTRD, EXPOSE, ASD2TH, CKBETW
C      /PROFMI/ - PREPR, PROSET, ASDT, LOAD, EXPOSG, EXPOSE, ASD2TH, ASDS2,
C                CKBETW
C      /PLOTBL/ - TIMISI
C      /PLOTR/ - NEWPNT, ASDT, LOAD, PPGRM, NWASDS, CKBETW
C      /RESALT/ - SETRES, ALTRRD, PREPR, ASDT, LOAD, ASD2TH, CKBETW
C      /RUNWAY/ - DELTA, SETRES, PREPR, ASDT, LOAD, RWYRD, PROFRD, EXPOSG,
C                EXPOSE, ASD2TH, PPGRM, CKBETW
C      /RWYUTL/ - MIXRD, ASDT, LOAD, RWYRD, ASD2TH, PPGRM, FIRST, CKBETW
C      /SCRACH/ - GRPRD, NEWPNT, TPROF, ALTRRD, MIXRD, ASDT, LOAD, RWYRD,
C                WINDRD, READIN, NOISRD, PROFRD, ASD2TH, PPGRM, NWASDS, CKBETW
C      /TGROUP/ - GRPRD, PREPR, MIXPD, ASDT, LOAD, EXPOSE, ASD2TH, CKBETW
C      /THRICK/ - BLOCK DATA, TIMISI, ASDT, LOAD, HBT, EXPOSG, EXPOSE, ASD2TH,
C                GRADIE, ASDS2, ASDS2G, FIRST, NWASDS
C      /TITLE/ - ASDT, LOAD, ASD2TH, PPGRM, CKBETW
C      /TRACK/ - BLOCK DATA, CONTG, GRPRD, HEIG, OVRLAY, PREPR, MIXRD, ASDT,
C                LOAD, RWYRD, XLINE, HBT, EXPOSG, EXPOSE, ASD2TH, ASDS2,
C                CKBETW
C      /TRAFIK/ - SIFT, MIXRD, ASDT, LOAD, EXPOSG, EXPOSE, ASD2TH, ASDS2G,
C                CKBETW
C      /VECBLK/ - BLOCK DATA, TIMISI, ASDT, LOAD, ASD2TH, POSCOO, CKBETW
C      /WIND/ - PREPR, ASDT, LOAD, VUNT, WINDRD, ASD2TH, CKBETW



C     THE FOLLOWING IS A SUMMARY OF ALL COMMON VARIABLES
C     APPEARING THROUGHOUT THE INM PACKAGE>>>>>>>>>>>>>>>>>>>>>>

C      /ALIMIT/
C      TP - AIRCRAFT THRUST SETTING
C      IP - AIRCRAFT NUMBER

C     /ASDS2/ - PARTIALLY INITIALIZED BY ASDS3TH
C     TWO - USER DEFINED ASDS THRESHOLD
C     NTH - NUMBER OF DOSE THRESHOLDS
C     TWO - USER DEFINED DOSE THRESHOLDS
C     DS - USER DEFINED DOSE TIMES
C     ---
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C     /ASDSPL/ - ASPROF GENERATED IN PREPP
C     ASPROF - FLIGHT PERFORMANCE PROFILE FOR A/C TYPE OF CURRENT FLIGHT.
C     THISI MODIFIES THIS PROFILE.
C     DISTANCES ARE ALWAYS MEASURED IN FEET FROM THE RUNWAY
C     TAKEOFF THRESHOLD.
C     DCL - DETERMINES SIZE OF NEXT TIME INCREMENT (1 - 5 DB).
C     SMALLER DCL INCREASES RESOLUTION &COMPUTING TIME.
C     TSSC - ANOTHER CHECK FOR TIME STEP SIZE. MUST NOT BE <1.
C     LARGER TSSC MEANS LARGER JUMPS IN NOISE LEVEL, POORER
C     RESOLUTION. SEE WYLE REPORT OR SOURCE.
C     DINT - INITIAL TIME INCREMENT IN SECONDS
C     DMINT - SMALLEST ALLOWABLE TIME STEP
C     DMAXT - LARGEST ALLOWABLE TIME STEP
C     TMIN - SMALLEST ALLOWABLE REAL TIME
C     TMAX - LARGEST ALLOWABLE REAL TIME
C     OMEGA - ANGULAR VELOCITY IN RADIANS PER SEC WITH WHICH A/C
C     IS ALLOWED TO CHANGE ITS NOSE-UP AND BANKING ANGLES
C     NTH - THRESHOLD VALUES FOR WHICH EXCEEDANCE TIMES WILL BE
C     CALCULATED. NUMBER OF THESE = NTH IN /THBLOK/
C     TOTALT - TOTAL TIMES OVER WHICH THISI HAS CALCULATED EXCEEDANCES
C     ASDST - THRESHOLD LEVEL EXCEEDANCE TIMES FOR EACH OBSERVER(SECONDS)
C     ENERGY - ACCUMULATED NOISE ENERGY ABOVE LOWEST THRESHOLD LEVEL (ONE FLYBY)

C      /BK/
C     TOL2 - CONTOUR ERROR TOLERANCE
C     TOL - SPARE COPY OF TOL2  CLOBBERED SOMETIMES<
C     XVAL - VAL NIETS  CONTRIBUTIONS FROM ALL DEFINED FLIGHTS< PLUS
C                 CONTRIBUTION FROM SIGNIFICANT FLIGHTS<
C     VAL - CONTOUR VALUE  LEVEL<
C     TNOY1 - NOISE CONTRIBUTION OF SIGNIFICANT FLIGHTS
C     NYS - RECORDS NUMBER OF TIMES THROUGH EXPOSE OR FOR CURRENT CONTOUR POINT
C     IERROR - ERROR FLAG
C     TOLLOP - PROXIMITY TO CONTOUR,FACTOR USED FOR LOOP CHECK
C                 COMPUTATION, USED ONLY IF SMALLER THAN TOL2
C     TOLSIG - NO LONGER USED

C     /BLK2/
C      FLITEP - FLIGHT PATH INFORMATION
C     IF THE FIRST INDEX IS            THE CONTENTS OF FLITEP  , < IS

C     1                                0. FOR STRAIGHT SEGMENT
C                                      1. FOR CIRCULAR SEGMENT
C     2                                STRAIGHT - X-COORD. OF SEGMENT
C                                           STARTING POINT
C                                      CIRCULAR - X-COORD. OF TURN
C                                           CENTER
C     3                                STRAIGHT - Y-COORD OF SEGMENT
C                                           START POINT
C                                      CIRCULAR - Y-COORD OF TURN
C                                           CENTER
C     4                                STRAIGHT - LENGTH OF SEGMENT
C                                      CIRCULAR - RADIUS. POSITIVE IF
C                                           TURNING LEFT, NEGATIVE IF
C                                           TURNING RIGHT  LOOKING
C                                           IN A DIRECTION AWAY FROM
C                                           THE RUNWAY, I.E. AS IF
C                                           IT WERE A T/O<
C     5                                STRAIGHT - X-COMPONENT OF
C                                           UNIT VECTOR IN DIRECTION
C                                           OF SEGMENT
C                                      CIRCULAR - TURN ANGLE
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C     S                                STRAIGHT - Y-COORD. OF UNIT
C                                           VECTOR IN DIRECTION OF
C                                           SEGMENT
C                                      CIRCULAR - ANGLE BETWEEN LINE
C                                           FROM TURN CENTER TO
C                                           SEGMENT START, WITH
C                                           POSITIVE X-AXIS
C     7                                ALTITUDE AT SEGMENT START
C     8                                SPEED IN KNOTS AT SEGMENT START
C
C                                      THRUST OVER SEGMENT IN LBS/
C                                           ENGINE
C
C
C
C     /CONST/
C      PI = 3.14159
C      R = 1
C
C     /DEFALT/
C     IFLDEF - CURRENT FILE INDICATOR
C     DEFTOT - DAILY TOTAL OPERATIONS
C     STEPS - DEFAULT NUMBER OF STEPS IN CONTOUR
C     POINTS - DEFAULT NUMBER OF POINTS IN CONTOUR
C     DEFTOL - DEFAULT CONTOUR TOLERANCE
C     DEFOPS - DEFAULT OPERATIONS  QUESTION MARK<  NEVER USED<
C     DEFVAL - DEFAULT CONTOUR THRESHOLD
C
C      /DIRVTY/
C      DC - DIRECTIVITY CHARACTERISTICS OF A/C NOISE
C      DCALPHA - ALPHAMERIC AIRCRAFT  ENGINE< TYPES TO WHICH DC RELATE
C
C      /EXSAB/
C      AB - COEFFICIENTS OF FUNCTIONS DESCRIBING EXCESS ATMOSPHERIC
C                ABSORPTION OF NOISE FOR EACH AIRCRAFT TYPE
C
C     /GRADNT/
C     GRADN - LAST COMPUTED UNIT GRADIENT VECTOR COMPONENTS
C     DERIV - SAME AS GRADNG, GRADIENT MAGNITUDE
C
C     /GRDBLK/
C     AS2ANS - ASDS MODE II CUMULATIVE TIME ABOVE THRESHOLD BY TRACK
C     FOR ALL FLIGHTS (FROM THISI)
C     (1,N) = REQUESTED T/A
C     (2,N) = - 10 DB FROM REQUESTED T/A
C     AS3ANS - AS AS2ANS FOR ASDS MODE III
C     AS2MN - MINIMUM THRESHOLD - ASDS MODE II-X
C     AS2MX - MAXIMUM ETC
C     AS3MN - MINIMUM THRESHOLD - ASDS MODE III (DOSE)
C     AS3MX - MAXIMUM ETC
C
C     /GRDBLK/
C     AS2ANS - ASDS NOISE EXPOSURE VALUES FROM CALLS TO EXPOSE BY GRADIE
C      BEWARE - IDENTICALLY NAMED VARIABLES IN GR2BLK<
C     AS3ANS - DOSE EXPOSURE VALUES FROM GRADIE
C     AS2MN - MINIMUM THRESHOLD - ASDS MODE II-X
C     AS2MX - MAXIMUM ETC
C     AS3MN - MINIMUM THRESHOLD - ASDS MODE III (DOSE)
C     AS3MX - MAXIMUM ETC
```

```
C
C     /GRDOUT/
C     POINT - COORDS OF CURRENT CONTOUR POINT FOR EXPOSG
C     ASDSPR - CUMULATIVE SUMMATION OF TIME ABOVE SIX THRESHOLD FOR 3
C     DEFINED TIME PERIODS (INCLUDING CURRENT ONE)
C     OTHERS - ESTIMATED VALUES OF OTHER NOISE METRICS AT CURRENT POINT
C     ASDSPI - T/A FOR 6 THRESHOLDS
C     FOR 3 TIME PERIODS FOR CURRENT FLIGHT ONLY
C
C     /LOOPS/
C     RC - FIRST GUESS AT POSITION OF NEW POINT; NEW POINT ON RETURN
C     RIN - COORDINATES OF PRESENT  TRIAL CONTOUR POINT
C     RPK - COORDS OF POSITION OF VALP  CONTOUR SEARCH TEST POINT<
C     W - SIGN OF EXPOSURE VALUE
C     VAL1 - PREVIOUS TRIAL EXPOSURE VALUE FOR CURRENT "POINT"
C     VAL2 - LATEST TRIAL EXPOSURE FOR ETC
C     D - DISTANCE BETWEEN CONTOUR POINTS
C
C     /METRIC/ - INITIALIZED BY METFIX
C     NMET - METRIC NUMBER  2**INTEGER NUMBER OF METRIC IN STANDARD LIST<
C     AMAYS - TABLE OF EXPOSURE VALUES AT CONTOUR POINTS
C     FOR METRICS OTHER THAN PRIMARY
C     PRMFCT - VALUE SUBTRACTED FROM FINAL SUMMATION OF SINGLE
C     EVENT NOISE EXPOSURE  APPLIES TO PRIMARY METRIC<
C     ALTFCT - APPLIES TO ALTERNATE ETC
C     PRMWE - EVENING WEIGHTING FACTOR FOR PRIMARY METRIC
C     PRMWN - NIGHT WEIGHTING FACTOR, PRIMARY METRIC
C     ALTWE - MULTIPLYING FACTOR IF ALTERNATE METRIC IS NEL
C     ALTWE - EVENING WEIGHTING FOR ALTERNATE METRIC
C     ALTWN - NIGHT WEIGHTING FACTOR FOR ALTERNATE METRIC
C     NUMPR - PRIMARY METRIC NUMBER  NOISE MEASURE USED<
C     1=NEF, 2=LDN, 3=CNEL, 4=LEQ, 5=ASDS, 6=DOSE
C     NUMALT - FLAG ARRAY INDICATING ALTERNATE METRIC NUMBER
C     METNIT - NAME OF NOISE METRIC  ASCII LITERAL<
C     METLEV - METRIC LEVEL  NEVER USED<
C
C     /MIXDTA/
C     IA - NUMBERS INDICATING NOISE CURVE SETS AND PERFORMANCE PROFILES
C     FOR UP TO 50 A/C TYPES:
C     (1,I): NOISE CURVE SET NUMBER
C     2: PROFILE FOR 0 - 500 NAUTICAL MILES
C     3:    "        500 - 1000     "
C     4:    "        1000 - 1500     "
C     5:    "        1500 - 2500     "
C     6:    "        2500 - 3500     "
C     7:    "        3500 - 4500     "
C     8:    "        4500 AND GREATER
C     NAMES - NAMES OF A/C TYPES  QUESTION MARK<
C     NAC - LARGEST AIRCRAFT DESTINATION NUMBER IN CASE
C     DAILY - CUMULATIVE OPERATIONS FOR D/E/N, LANDING AND 7 TAKEOFF STAGES
C     NPCHAC - TABLE OF AIRCRAFT TYPES FOR TINISI
C
C     /NOISE/
C     SLRNG - SLANT RANGES (LOGARITHMS INTERNALLY, BUT INPUT AS
C     REAL NUMBERS)
C     GRNDA - GROUND ATTENUATION
C     PWRS - AIRCRAFT THRUST TABLE (POWER SETTINGS FOR NOISE CURVE SET)
C     ANOISE - EPNL DATA FOR NOISE CURVES  (AT UP TO ,
C     ANOISE - EPNL DATA FOR NOISE CURVES (AT UP TO 8 DISTANCES)
C     NOAC - NUMBER OF DEFINED AIRCRAFT
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C     BNOISE - NOISE CURVES, CNEL
C     CUTCRN - TABLE OF CUTOFF DISTANCES ABOVE WHICH FURTHER NOISE COMPUTATIONS
C              ARE NOT PERFORMED
C
C     /PROFIL/
C     APPTHR - AIRCRAFT THRUST SETTINGS TABLE
C     MATCH -  TABLE OF AIRCRAFT TYPES REFERENCED BY PROFILE NUMBER
C
C     /PROFNT/
C     DR - PROFILE RESTRICTIONS
C     NSEGS - NUMBER OF SEGMENTS IN PERFORMANCE PROFILE
C
C     TOPI - INDICATES TAKEOFF (+1.0) OR LANDING (-1.0)
C
C     STR - START RANGE (DISTANCE FROM ANALYSIS POINT TO AIRCRAFT
C
C     CLOSEST APPROACH)
C     ITYPE - APPROACH PROFILE LOOKUP ARG (A/C TYPE)
C
C     /PLOTBL/ - FILED BY TIHIS1 IF NPLP IS POSITIVE
C     KK - NUMBER OF POINTS IN THE TIME HISTORY
C     TGPL - SOUND ARRIVAL TIMES (SECONDS). WORDS 401,402 ARE PLOT SCALE
C     ASPL - A - WEIGHTED NOISE LEVELS (DB) CORRESPONDING TO TGPL
C     COORD - A/C POSITION AND ORIENTATION CORRESPONDING
C     TO TGPL, ASPL. SECOND INDEX MEANS:
C     1 -X COORD, 2 - Y COORD,
C     3 - ANGLE IN RADIANS OF A/C LOGITUDINAL AXIS WITH  POS X - AXIS
C
C     /PLOTR/
C     IPSIZ - NUMBER OF CONTOURS
C     DBIS - MAXIMUM ALLOWABLE DISTANCE BETWEEN CONTOUR POINTS (SEARCH)
C     NPLOT -  NUMBER OF PLOTS  PHYSICALLY DISTINCT  QUESTION MARK<<
C     XSP - AREA ACCUMULATOR
C     PT - COORDS OF LAST GOOD POINT ON CONTOUR
C     PSCALE - PLOT SCALE FACTOR
C
C     /RESALT/ - PARTIALLY INITIALIZED BY SETRES
C     NTAR - PROCEDURE NUMBER  ABATEMENT TYPE< ASSIGNED TO ECH TRACK
C     ENDR - DISTANCE ALONG TRACK TO END OF RESTRICTION INDEXED BY RESTR #
C     STR - DISTANCE ALONG TRACK TO BEGINNING OF RESTRICTION
C     ICDT - TABLE OF RESTRICTION TYPES  INDEXED TO ORGSTR, ORGEND, ETC<
C      NOISE ABATEMENT<
C     GCBK - TABLE OF CUTBACK  CLIMB< GRADIENTS  INPUT TAKEOFF<
C     ICBNCO - CUTBACK MODE OVERRIDE ARRAY
C     ENDALT - ALTITUDE ABOVE GROUND AT END OF TAKEOFF RESTRICTION
C     ORGSTR - DISTANCE FROM BRAKE RELEASE POINT WHERE TAKEOFF
C     RESTRICTIONS BEGIN, INDEXED BY "RESTRICTION NUMBERS"
C     ORGEND - ETC WHERE RESTRICTIONS END, ALSO INDEXED BY ETC
C      BOUNDARIES OF ABATEMENT PROCEDURE<
C
C     /RUNWAY/
C     APALT -  AIRPORT PRESSURE ALTITUDE
C     APTEMP - AIRPORT TEMPERATURE  DEGREES KELVIN INTERNALLY<
C     XA - TABLE OF RUNWAY STARTS  BRAKE RELEASE< COORDS  ARRIVAL<
C     XD - TABLE OF RUNWAY END COORDS  DEPARTURE<
C     RL - RUNWAY LENGTHS
C
C     /RWYNT/
C     RUSE - CUMULATIVE NUMBER OF OPERATIONS INDEXED BY
C     DEPARTURES 1<, ARRIVALS 2<; RUNWAY; DAY,EVENING,NIGHT
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```
C     NAMR - TABLE OF RUNWAY NAMES,1 -> DEPARTURE, 2 -> ARRIVAL
C     NRWY - NUMBER OF DEFINED RUNWAYS
C     IRBIG - NUMBER OF BUSIEST TAKEOFF RUNWAY
C                   COUNTS NUMBER OF AIRCRAFT TYPES, ETC<
C
C     /SCRACH/
C      X - X COORDINATES OF CURRENT CONTOUR
C        Y - Y ETC
C      NOY1 - NOISE EXPOSURE
C        PROF - TABLE OF AIRCRAFT PERFORMANCE  GROUND TRACK ALTITUDE<
C
C     /TGROUP/
C     DCOM - CONTAINS THE DISTANCE THE TRACKS IN AGROUP HAVE
C     IN COMMON FOR UP TO 25 GROUPS  SIGH<
C     ITRG - GROUP NUMBERS INDEXED BY TRACK NUMBERS
C
C     /THBLCK/
C     MTRK - TRACK NUMBER
C     NTS - NUMBER OF TRACK SEGMENTS IN CURRENT TRACK
C     NPS - NUMBER OF PROFILE SEGMENTS
C     NOBS - NUMBER OF OBSERVATIONS
C     ITAC - A/C NUMBER
C     NSTEP - MAXIMUM ALLOWABLE NUMBER OF TIME STEPS IN ONE SEGMENT
C     NTH - THRESHOLD NUMBER
C     DATRK - DISTANCE (FEET) FROM POINT OF CLOSEST APPROACH TO FIRST OBSERVER
C     MEASURED ALONG GROUND TRACK AT THRESHOLD OF RUNWAY WHICH
C     WOULD BE USED IF IT WERE A TAKEOFF TRACK. CANNOT BE LONGER
C     THAN TRACK. IF NEGATIVE, START OF TRACK WAS CLOSEST APPROACH
C     M - +1 FOR TAKEOFF, -1 FOR LANDING
C     ICHECK - SET TRUE IF TIHISI EXPECTED TO CHECK ARGS & PARAMETERS
C                   IN /ASDSBL/
C     IDETL - TRUE IF DETAILED DIAGNOSTICS DESIRED
C     VO - UP TO 20 VECTORS POINTING TO HYPOTHETICAL OBSERVERS
C     NPLP - NUMBER OF TIMES ACTUAL NOISE LEVEL TIME HISTORY AND A/C POSITION,
C     DIRECTION DEPOSITED IN TGPL, AIPI, COORD. IF
C     NPLP IS LESS THAN OR EQUALS ZERO, TGPL AND ALPL ARENT FILLED. IF ACTUAL
C     NUMBER OF TIME STEPS EXCEEDS THIS, TIHISI HICCUPS.
C     LENERGY - TRUE IF ACCUMULATED ENERGY NOISE LEVELS ARE TO BE CALCULATED
C
C     /TITLE/
C     TITL - DESCRIPTIVE HEADING OF AIRCRAFT DATA BASE FILE
C     BANNER - USER PROVIDED HEADER FOR OUTPUT
C     AP - CONTOUR OUTPUT TITLE
C     ANLT - AIRPORT ALTITUDE
C     OAPT -ANOTHER OUTPUT TITLE
C      TPD - MORE TITLE PUBBISH
C
C     /TRACK/
C     ITR - TABLE OF RUNWAY NUMBERS FOR EACH TRACK  0 IF TRACK IS UNDEFINED<
C     ITSEG - CONTAINS THE NUMBER OF TRACK SEGMENTS FOR A GIVEN TRACK
C     IN THE LOW ORDER 7 BITS OF THE WORD.  THE HIGH
C     ORDER 15 BITS CONTAIN INFORMATION REGARDING THE TRACK SEGMENTS
C     FOR A GIVEN TRACK. IF THE BIT IN POSITION A, COUNTING FROM
C     THE HIGH ORDER TO THE LOW ORDER, IS A BINARY C,
C     THEN SEGMENT A IS STRAIGHT. IF 1, IT'S A TURN.
C     MASK - BINARY MASKING CONSTANTS USED TO PLAY WITH ITSEG,ITPRAC, ETC
C     PARAM - FOR STRAIGHT SEGMENTS: START COORDS X,Y<,
C     LENGTH, UNIT VECTOR COMPONENTS ALONG DIRECTION  X,Y<
C     FOR CIRCULAR SEGMENTS: TURN CENTER COORDS X,Y<, RADIUS
C      + = RT, - = LT<, START ANGLE RADIANS<, ANGLE BETWEEN
C     CHORD FROM START TO CENTER AND POSITIVE X DIRECTION
```

```
C     TTD - TOTAL TRACK DISTANCES  FROM BEGINNING OF TRACK TO
C     END OF EACH SEGMENT EXCEPT THE LAST<
C     DMIN - SMALLER OF 1/2 MINIMUM TURN RADIUS OR SHORTEST
C     SEGMENT LENGTH FOR EACH TRACK
C
C     /TRAFIK/ - PARTIALLY INITAILIZED BY MIXRD
C     NTT - TOTAL NUMBER OF DISTINCTLY DEFINED FLIGHTS
C     (TOTAL USED TO FIND A CONTOUR POINT)
C     ITT - FLIGHTS USED TO FIND LATEST CONTOUR POINT
C     ITPRAC - TABLE OF ENCODED PROPERTIES OF !SIGNIFICANT! FLIGHTS
C     FLIGHT IDENTIFICATION CODES (POSITION 0 LSB)
C     ) - 9 : NOISE CURVE SET NUMBER MINUS 1
C
C     1 - 12: PERFORMANCE PROFILE NUMBER
C
C     13 - 19: GROUND TRACK NUMBER
C
C     20 - 25: TRACK GROUP NUMBER
C     MOST SIG BIT: 1 IF FLIGHT !SIGNIFICANT!, 0 IF NOT
C     NOPS, MOPS - CONTAINS THE WEIGHTED NUMBER OF OPERATIONS FOR
C     EACH INDIVIDUALLY DEFIND FLIGHT FOR ALL METRICS.
C     LEQ, ASDS, AND DOSE ALL HAVE THE SAME WEIGHTING SO
C     THE OPERATIONS FOR CURRENT FLIGHT CAN BE FOUND AT
C     NOPS(KX,2)
C      MOPS - SEE NOPS
C
C     /VECBLK/
C     VA - COORDINATE POSITION OF A/C IN AIRPORT REFERENCE FRAME
C     VALPHA - UNIT VECTOR COMPONENTS FOR ALPHA IN A/C REFERENCE FRAME
C     VBETA -BETA IN A/C REF FRAME
C     VGAMMA GAMMA IN A/C REF FRAME
C     VD - VECTOR POINTING FROM A/C TO OBSERVER NOT FIXED  AIRPORT<
C     COORD FRAME
C     VD2 - AS VD, BUT NOT TO A/C COORD FRAME
C     /WIND/
C     VEL - WIND VELOCITIES
C     DIR - WIND DIRECTIONS
C     INDEX1 - LIST OF NOISE CURVE NUMBERS INDEXED TO AIRCRAFT IN USER INPUT
C     INDX1 - LIST OF NOISE CURVE NUMBERS INDEXED TO AIRCRAFT IN USER INPUT
C     INDX2 - LIST OF PROFILE ETC
C     TOL1 - CONTOUR TOLERANCE  NEVER CHANGED<
C     TOL - CONTOUR TOLERANCE   CHANGED SOMETIMES BY NEWPNT<
C     XVAL - PREVIOUS CONTOUR VALUE LEVEL<
C     VAL - LATEST CONTOUR VALUE LEVEL<
C     TRY1 - TRIAL NOISE EXPOSURE
C     JYS - NUMBER OF ITERATIONS REQUIRD TO FIND CONTOUR POINT
C     IERROR - ERROR FLAG
C     TOLLOP - LOOP CHECK TOLERANCE  * THE STEP SIZE -- IS LOOP CLOSING?<
C     TOLSIG - SIFT TOLERANCE  * THE STANDARD DEVIATION<
C
```

Main Program GRIDS

```
C     MAIN PROGRAM FOR GRID ANALYSIS RUNS
C     GRID CALLS THE FOLLOWING SUBROUTINES DIRECTLY
C     USER  EXIT  LOAD  DATE
C     READIN  SKFIL  EXPOSR  PLOTER
```

```
C     NOTES: GRID MAY (BUT NEED NOT NECESSARILY) BE RUN FROM
C     TAPE INPUT GENERATED BY NOISE AND CONTOUR. IT EXPECTS A
C     "THRESH" (THRESHOLD CONTROL CARD) AND EVIDENTLY ASSUMES
C     ALL A/C ,PROFILES, ETC HAVEN'T CHANGED FROM THE TAPED
C     INPUTS RUN. SOME OF THE MOST OPAQUE CODE IN THIS
C     ROUTINE INVOLVES LABELING THE PRINTED OUTPUT TO CORRESPOND
C     TO THE PLOTTED CONTOUR
C     LOCAL VARIABLE DICTIONARY
C     A - ALTITUDE (Z COORD) OF CURRENT GRID POINT
C     AFLAG1 - X OFFSET, GRID QUADRANT
C     AFLAG2 - Y OFFSET, GRID QUADRANTS
C      AIRCRF - STORAGE FOR AIRCRAFT DEFINITION RECORDS
C     ALT - A/C HEIGHT ABOVE RUNWAY (SECONDARY SEG)
C     AVAILS- AS AVAILS, WEIGHTED BY VELOCITY, SHIELDING, ATTENUATION
C     AND DECIBEL CORRECTIONS
C      BANNER - USER PROVIDED HEADER FOR OUTPUT
C      CONTR - NOISE CONTRIBUTION OF AIRCRAFT WITH ASSIGNED NOISE CURVES
C      AT A CHOSEN POINT
C     DA -DECIBEL CORRECTION FOR SEGMENT CLOSET TO GRID POINT
C     DAT - DISTANCE ALONG TRACK FROM THRESHOLDTO CLOSEST POINT
C      DATER - CONTAINS DATE  M/D/Y<
C      DB - DECIBEL CORRECTION FOR SECONDARY SEGMENT
C     DST - DISTANCE ALONG TRACK TO CLOSEST POINT ON SECONDARY SEG
C     DT - DISTANCE TO TRACK FROM GRID POINT
C      GA - GROUND ATTENUATION CORRECTION
C      HED1 - OUTPUT HEADER
C      HED21 - OUTPUT HEADER
C      HED22 - OUTPUT HEADER
C     HT - ALTITUDE OF AIRCRAFT (FEET), PRIMARY SEGMENT
C      I - ALL PURPOSE EVER POPULAR LOOP COUNTER  WORLD FAVORITE<
C     IALFA - LETTERS OF THE ALPHABET (GRID QUADRANT IDS)
C     ICHAR - QUDRANT LABEL CHARACTER
C     ICMT - USER COMMENT FILED ON CONTROL CARD
C     ICOMB - IDENTIFIERS OF METRIC TYPES (ASCII)
C      ICON - COMMAND LITERAL 5HCON
C      IEND - COMMAND LITERAL 5HEND
C     IEP - FLAG TO CALCULATE ALTERNATE NOISE METRICS
C     IFIL - TAPE FILE NUMBER OF CURRENT CONTOUR
C     IFST - BUFFER FOR USER INPUT CONTROL WORD
C      IGRID - COMMAND LITERAL 5HGRID
C     IOP - PRINTOUT OPTIONS (COMPARISON ARRAY)
C     IOPTN - PRINTOUT OPTION FLAG ARRAY
C      IMOR - COMMAND LITERAL 5HMOR
C      INDX1 - LIST OF NOISE CURVE NUMBERS INDEXED TO AIRCRAFT IN USER INPUT
C      INDX2 - LIST OF PROFILE     NUMBERS INDEXED TO AIRCRAFT IN USER INPUT
C     ITAC - NOISE CURVE NUMBER
C     ITFII - NUMBER OF FILES TO SKIP TAPE FOR NEXT CONTOUR
C      ITIM - NOT USED  MISSPELLED MAYBE<
C      ITN - OUTPUT LABEL  SEE DATA STATEMENT<
C     ITPRAC - ENCODED REFERENCE WORD(TRACK GROUP
C     NUMBER, TRACK NUMBER, PROFILE NUMBER, ETC)
C      ITHRESH - COMMAND LITERAL 5HTHRSH
C      IXCOOR - GRID QUADRANT COORD  GRID OUTPUT<
C     JCON - FLAG INDICATING DATA TO MODIFY EXISTING BASE
C     NX - FLIGHT NUMBER
C     L - NUMBER OF POINTS IN GRID  NX TIMES NY<
C     LUN - LOGICAL UNIT NUMBER OF CONTOUR STORAGE TAPE
C      MASK - BINARY MASKING CONSTANTS USED WITH ITPRAC, ETC
C     MAXS - SEGMENT NUMBER OF TRACK CLOSET TO GRID POINT

C     MAXT -SEGMENT USED FOR SECONDARY CONTRIBUTION
```

```
C      NCON - NUMBER OF CONTIGOUS SEGMENTS  MAYBE<

C       NFTT - TOTAL NUMBER OF DISTINCTLY DEFINED FLIGHTS
C       NOCOM - COMMAND LITERAL
C      NPRF - PROFILE NUMBER
C       NPTS - NUMBER OF GRID POINTS  COUNTED MAYBE<
C      NRW - RUNWAY NUMBER
C       NTAB - PROCEDURE NUMBER  ABATEMENT TYPE< ASSIGNED TO EACH TRACK
C      NTG - TRACK GROUP ASSIGNMENT
C      NTRK - TRACK NUMBER
C      NUMPGS - PAGE CONTROL (LIMIT) FLAG FOR OPTIONS 3 AND 4
C      NUMPTS - COUNTER TO CONTROL NUMBER OF GRID POINT LISTINGS
C      PER PAGE OF OUTPUT
C      NX - NUMBER OF X COORDS IN GRID
C      NY - NUMBER OF Y COORDS IN GRID
C       OTHERS - ESTIMATED VALUES OF OTHER NOISE METRICS AT CURRENT POINT
C      P - PLANAR COORDS OF POINT AT WHICH NOISE EXPOSURE IS CALCUALTED
C      P - S & Y COORDS OF CURRENT GRID POINT IN EXPOSURE CALCULATION
C      PWR - AIRCRAFT POWER SETTING
C       SLRNG - SLANT RANGE
C      TT - THRUST OF AIRCRAFT (POUNDS/ENGINE)
C      TRSH - TABLE OF 6 THRESHOLD VALUES FOR CONTOURS
C      V - VELOCITY OF AIRCRAFT (KNOTS)
C       VE - WIND VELOCITY
C      VW - COMPONENT OF WIND VELOCITY IN DIRECTION OF TRACK SEGMENT
C      WFCTRS - TABLE OF WEIGHTING FACTORS FOR ALTERNATE METRICS
C      X - X GRID COORDINATES
C      XLG - LARGEST X-COORD ON CONTOUR
C      XPP1 - X OFFSET, FEET/1000
C      XPP2 - Y OFFSET, FEET/1000
C      XS - STARTING X - COORD OF GRID
C      XSM - SMALLEST X- COORD ON CONTOUR
C      XSTP - NUMBER OF FEET BETWEEN X VALUES IN GRID
C       YSTP - NUMBER OF FEET BETWEEN Y VALUES IN GRID
C      Y - Y GRID COORDINATES
C      YLG - LARGEST Y - COORD ON CONTOUR
C      YS - STRATING Y - COORD
C      YSM - SMALLEST Y - COORD ON CONTOUR
      LOGICAL INSIDE
      EXTERNAL INSIDE
      LOGICAL NCON,IORTH
CC
```

Function ACNOIS

```
      FUNCTION ACNOIS (ITAC,SLRP,THR,K,KX,J,IAPP)                    06-09-79
C
C*****************************************************************************
C       LOCAL VARIABLE DICTIONARY
C       ACNOIS - PRIMARY METRIC LEVEL
C       ANOISE - TABLE OF EPNL VALUES (DATA)
C       AVALS - PRIMARY AND ALTERNATE METRIC LEVELS
C       BNOISE - TABLE OF NEL VALUES (DATA)
C       T - LAST VALUE IN X COORD 2 DIMENSIONAL INTERPOLATION LESS THAN
C                   INTERPOLATED X VALUE
C      ITAC - A/C TYPE
C       IVX - ASSIGNED LABEL VARIABLE
C      J - TA CALCULATION FLAG (SET BEFORE ENTRY)
C      K - ERROR FLAG (SET BEFORE RETRY BY CALLING ROUTINE)
```

```
C      KK - ARRAY ARGUMENT OF LARGEST THRUST IN A/C THRUST SETTING TABLE
C                  NOT GREATER THAN THR
C      KX - NUMBER OF OPERATIONS FOR TA CALCULATIONS
C      L - CONSTANT
C      M - NUMBER OF VALUES IN X TABLE FOR 2D INTERPOLATION
C      N - NUMBER OF Y VALUES FOR 2D INTERPOLATION
C   NOAFTB - 2 IF ONE OF THE THREE AIRCRAFT WHICH USES AFTERBURNER      06-11-79
C            THRUST IN THE FIRST COLUMN OF ITS NOISE CURVE TABLES.      06-11-79
C            IF A LANDING, THIS PART OF THE NOISE CURVE WILL BE IGNORED 06-11-79
C      NUMALT - ALTERNATE METRIC IDENTIFIERS
C     NUMPR - PRIMARY METRIC NUMBER (SEE BELOW)-
C      PWRS - POWERS SETTINGS
C     SL - SLANT RANGE, LOG
C      SLRNG - TABLE OF SLANT RANGES
C     SLRR - SLANT RANGE, DECIMAL
C     THR - A/C THRUST SETTING
C  ACNOIS - FUNCTION SUBROUTINE
C  THE PURPOSE OF THE FUNTION SUBROUTINE ACNOIS IS TO COMPUTE THE
C  NOISE EXPOSURE LEVEL FOR A SINGLE FLIGHT IN TERMS OF ANY COMBINATION
C  OF METRICS.  WHILE NO ACTUAL COMPUTATIONS ARE PERFORMED IN ACNOIS
C  ITSELF, APPROPRIATE OTHER SUBROUTINES ARE ACCESSED AS NECESSARY FOR
C  EACH METRIC (I.E., NEF, LDN, CNEL, TEQ, ASDS, OF DOSE).  THE SUB-
C  ROUTINES USED BY ACNOIS AND THEIR FUNCTIONS ARE AS FOLLOWS:
C  GENEN2 - LOG-LINEAR-TWO-DIMENSIONAL INTERPOLATION IN "ENERGY" METRIC
C  NOISE TABLES
C  ASDS2 - DETERMINES ASDS LEVEL
C  ASDS3 - DETERMINES DOSE LEVEL
C  ACNOIS HAS ONLY ONE ENTRY POINT AND ITW CALLING SEQUENCE IS AS
C  FOLLOWS:  ACNOIS(ITAC, SLR, THR, K, KX, J)
C  WHERE
C  ITAC - NOISE CURVE SET NUMBER ASSOCIATED WITH THE AIRCRAFT FO THIS
C  FLIGHT.
C  SLR - THE MINIMUM SLANT DISTANCE FROM THE POINT BEING ANALYZED TO
C  THE AIRCRAFT FOT THIS FLIGHT.
C  THR - THE CORRECTED NET THRUST IN POUNDS PER ENGINE AT THE POINT OF
C  MINIMUM SLANT DISTANCE (ABOVE) FOR THIS FLIGHT.
C  K - INDICATED WHETHER TO COMPUTE THE EXPOSURE LEVELS FOR THE
C  ALTERNATE METRICS IN ADDITION TO THE PRIMARY METRIC.  IF K IS EQUAL
C  TO 1, THE ALTERNATES ARE ALSO COMPUTED.  OTHERWISE, ONLY THE PRIMARY
C  IS COMPUTED.
C  KX - THE NUMBER OF THIS FLIGHT.  IT IS ONLY MEANINGFUL HERE IF ASDS
C  OR DOSE LEVELS ARE BEING COMPUTED AND KX IS TRANSFERRED TO FUNCTION
C  SUBROUTINES ASDS2 AND/OR ASDS3.
C  J - INDICATES WHETHER OR NOT TO COMPUTE LEVELS FOR THE ASDS AND DOSE
C  ALTERNATE METRICS.  IF J IS LESS THAN 5, THE LEVELS ARE NOT COMPUTED
C  ; OTHERWISE, THEY ARE COMPUTED.
C  IN ADDITION TO THE CALLING ARGUEMENTS, ACNOIS ALSO RETRIEVES
C  INFORMATION FROM LABELED COMMON BLOCKS/NOISE/ AND/METRIC/. /NOISE/
C  CONTAINS SLANT DISTANCE (SLRGN) DATA CORRESPONDING TO STORED EPNL

C  VALUES (ANOISE) AND NEF VALUES (BNOISE).  THE RESPECTIVE POWER

C  SETTINGS ARE INCLUDED AS WELL (PWRS). /METRIC/ CONTAINS THE NUMBERS
C  (1-6 BELOW) CORRESPONDING TO THE PRIMARY METRIC (NUMPR) AND THE
C  ALTERNATE METRICS (NUMALT).
C  THE FUNCTION ACNOIS IS CALLED BY ONLY ONE PROGRAM, FUNCTION
C  SUBROUTINE EXPOSE, AND IS CALLED MANY TIMES DURING EXECUTION.
C  ACNOIS HAS TWO EXIT POINTS.  IF ALTERNATE EXPOSURE LEVELS ARE NOT
C  COMPUTED, THE LEVEL FOR THE PRIMARY METRIC IS COMPUTED AND THE  EXIT
C  RETURN IS IMMEDIATE.  IF THE ALTERNATES ARE COMPUTED, THE PRIMARY IS
C  COMPUTED FIRST, THE THE ALTERNATES.  THE SECOND EXIT RETURN COMES
```

```
C  AFTER THE FUNCTION NAME IS SET TO THE VALUE OF THE LEVEL FOR THE
C  PRIMARY METRIC.  THE LEVELS FOR BOTH THE PRIMARY METRIC AND
C  ALTERNATE METRICS ARE STORED IN THE LABELED COMMON BLOCK/METRIC/
C  UNDER THE NAME (AVALS).  THE POSITION NUMBER OF THE LEVELS IN TABLE
C  AVALS CORRESPONDS TO THE NUMBER OF THE METRIC AS FOLLOWS:
C  1  NNF
C  2  LDN
C  3  CNEF
C  4  PNLD
C  5  PSDS
C  6  DOSE
```

Function AL

```
      FUNCTION AL (V,AVD,F,J)
C
C     ***************************************************************

C      LOCAL VARIABLE DICTIONARY

C      ABSPJ - ABSOLUTE VALUE OF DISTANCE CRITERIC
C      ABSPJ - ABSOLUTE VALUE OF EXPOSURE CUTOFF DISTANCE FOR NOISE CURVE 11
C      AI - A WEIGHTED ECIBEL LEVEL
C      AL1 - CONTRIBUTION FROM THE JET EXHAUST TO VALUE AL
C      AL2 - CONTRIBUTION FROM FRONT FAN
C      AL3 - CONTRIBUTION FROM F
C      AL3 - CONTRIBUTION FROM REAR FAN
C      AVD - RETURNS MAGNITUDE OF VECTOR V TO CALLING PROGRAM
C      B7 - ELEVATION ANGLE
C      DC - TABLE OF CUTOFF DISTANCES FOR THE SEVERAL NOISE CURVES
C      DC2 - PI MINUS APPROPRIATE CUTOFF ANGLE FROM DC
C      DJ - VALUE OF AN APPROXIMATING FUNCTION USED IN EXHAUST NOISE COMPUTATION
C
C      EXATT - ANOTHER INTERMEDIATE RESULT (SO SEE THE WYLE BOOK OR
C                  LOOK UP THE BUGGERING TECHNICAL REFERENCES, THE EARLIEST IS
C                  FROM 1954...)
C      F - THRUST SETTING OF THE AIRCRAFT
C      FP - THRUST SETTING USED IN PREVIOUS CALL
C      FR - THRUST RATIO
C      FREF - INTERMEDIATE RESULT
C      GJET - SLOPE AND INTERCEPT VALUES FOR LINEAR APPROXIMATIONS TO
C                  EQUATION FOR D(THETA) ON PAGE PAGE 2-11 OF WYLE
C      RESEARCH PROGRAMMERS MANUAL, WCR77-7, DOT-CS-50256)
C      IRJ - INTERMEDIATE RESULT
C      IREF - INTERMEDIATE RESULT
C      JP - AIRCRAFT NUMBER FROM PREVIOUS CALL
C      PP - COEFFICIENTS OF FUNCTIONS DESCRIBING EXCESS ATMOSPHERIC
C                  ABSORPTION OF NOISE FOR EACH AIRCRAFT TYPE
C      PFF - INTERMEDIATE RESULT FROM FRONT FAN COMPUTATION
C      PFR - INTERMEDIATE RESULT FROM REAR FAN COMPUTATION
C      PID -
C      PID2 - PI DIVIDED BY TWO
C      PJ - YET ANOTHER INTERMEDIATE RESULT
C      PSI - AN AMUSING ANGLE
C      PSIDEG - PSI EXPRESSED IN DEGREES
C      PSIZ - A SIMILAR ANGLE TO PSI IN A DIFFERENT PLANE
C      TFM - INTERMEDIATE RESULT
C      TFMLOG - LOG TFM
C      TLOGS - LOGARITHMS OF THE DEFAULT THRESHOLDS
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C      M2 - THRUST RATIO    (NOT RELATED TO ANY SURVEILANCE ACTIVITIES, HAHA)
C      M3 - THRUST RATIO
C      M4 - THRUST RATIO
C      V - FIRST THREE LOCATIONS ARE VECTOR FROM AIRCRAFT TO ANALYSIS POINT
C
C  AL - FUNCTION SUBROUTINE
C  THE FUNCTION SUBROUTINE AL COMPUTES THE A-WEIGHTED DECIBEL LEVEL AT
C  A POINT FROM A FLIGHT AT A GIVEN POSITION.  THEIS SUBROUTINE IS USED
C  IN THE CALCULATION OF ASDSAND DOSE LEVELS.  SUBROUTINE AL DOES NOT
C  USE ANY EXTERNAL SUBROUTINES BUT CONTAINS THREE INTERNAL SUBROUTINES
C  AL HAS ONE ENTRY POINT ONLY AND THE CALLING SEQUENCE IS:
C  AL(V, AVD, F, J)
C  WHERE
C  V - A VARIABLE OF DIMENSION 3 OR M RE SUCH THAT THE FIRST 3
C  LOCATIONS DEFINE A VECTOR POINTING FROM THE AIRCRAFT TO THE ANALYSIS
C  POINT AND
C  V(1) = X-COORDINATE
C  V(2) = Y-COORDINATE
C  V(3) = Z-COORDINATE
C  AVD - THE MAGNITUDE OF VECTOR V IS COMPUTED BY AL AND RETURNED VIA
C  THIS ARGUMENT.
C  F - THE THRUST SETTING OF THE AIRCRAFT.
C  J - A NUMBER CORRESPONDING TO THE AIRCRAFT FOR THIS FLIGHT.  VALID
C  NUMBERS ARE AS FOLLOWS: (ALL JET AIRCRAFT)
C  1--3-NOT USED.
C  4-2-ENGINE STOL
C  5-4-ENGINE NARROW BODY TURBOJET
C  6-2-ENGINE NARROW BODY TURBOFAN
C  7-2-ENGINE NARROW BODY (QUIET NACELLE)
C  8-3-ENGINE NARROW BODY TURBOFAN
C  9-3-ENGINE NARROW BODY (QUIET NACELLE)
C  10-4-ENGINE NARROW BODY TURBOFAN
C  11-4-ENGINE NARROW BODY (QUIET NACELLE)
C  12-2-ENGINE WIDE BODY
C  13-3-ENGINE WIDE BODY
C  14-4-ENGINE WIDE BODY
C  AL IS CALLED BY ONLY ONE PROGRAM, SUBROUTINE TIHISI, BUT IS CALLED
C  MANY TIMES WHEN THE ASDS OR DOSE METRICS ARE COMPUTED.  VARIABLE
C  INFORMATION IS PASSED TO AL THROUGH THE ARGUMENTS V,F, AND J AS
C  PREVIOUSLY DISCUSSED.  "FIXED" DATA IS RETRIEVED FROM LABELED COMMON
C  BLOCKS/DIRVTY/,/ALINIT/AND/EXAPP/.  DATA REFLECTING THE DIRECTIVITY
C  CHARACTERISTICS OF NOISE EMISSIONS FOR THE ENGINE TYPES (I.E.
C  AIRCRAFT TYPES) IS FOUND IN (DC) WHICH IS CONTAINED IN /DIRVTY/.
C  THE VARIABLES IN /ALINIT/ ARE NOT REALLY FIXED IN THE SENSE THAT
C  THEY DON'T CHANGE, BUT ARE USED BY AL TO INDICATE TO ITSELF WHAT
C  VARIABLES WERE USED FOR THE PREVIOUS CALL.  IF THE THRUST (FP) AND
C  AIRCRAFT NUMBER (JP) WERE THE SAME LAST TIME AS FOR THE CURRENT CALL
C  (F AND J RESPECTIVELY), A SIGNIFICANT NUMBER OF INITIALIZATION
C  COMPUTATIONS MAY BE OMITTED SINCE THE RESULTS ARE UNCHANGED FROM
C  LAST TIME.  THIS SAVES SOME COMPUTATION TIME.  THE VARIABLES IN (PP)
C  CONTAINED IN /EXAPP/ CONSIST OF COEFFICIENTS OF FUNCTIONS DESCRIBING
C  EXCESS ATMOSPHERIC ABSORPTION OF NOISE FOR EACH AIRCRAFT TYPE.
C  THERE IS ONLY ONE EXIT RETURN FROM AL AND IT IS USED UNDER ALL
C  CONDITIONS.  THE A-WEIGHTED DECIBEL LEVEL IS RETURNED THROUGH THE
C  FUNCTION NAME AND THE DISTANCE BETWEEN THE ANALYSIS POINT AND THE
C  AIRCRAFT (I.E., THE MAGNITUDE OF V) IS RETURNED VIA THE CALLING
C  ARGUMENT AVD.
C  V = VECTOR FROM AIRCRAFT TO OBSERVER, F=THRUST, J=AIRCRAFT
C  TYPE INDICATOR.
```

Subroutine ALTRRD

```
      SUBROUTINE ALTRRD (IGO,NR,IDUMP)
C
C     ******************************************************************
C
C      LOCAL VARIABLE DICTIONARY
C
C     B - RESTRICTION END
C     G - RESTRICTION GRADIENT
C      GCRN - INPUT TAKEOFF GRADIENT
C      ICBNCO - INTEGER CUTBACK NUMBER CUTBACK OVERRIDE
C      ICBT - INTEGER CUTBACK TYPE
C     IDUMP - DUMP ERROR FLAG ) RESTRICTION NUMBER(
C     IGO - ERROR FLAG
C      IGO1 - ALTERNATE RETURN FROM MESSAGE
C      IND - FLAG SET IF IRET IN MESSAGE IS LESSTHAN ZERO
C     IT - LOOKUP ARG, TRACK NUMBER TO RESTRICTION NUMBER
C      ITR - FIRST 30 X COORDINATES OF CONTOUR
C      I - PERFORMANCE PROFILE NUMBER (CALL TO SETPES)
C     NR - RESTRICTION NUMBER
C     NRT - RESTRICTION TYPE
C     NRX - RESTRICTION NUMBER AS INPUT
C      NTAR - PROCEDURE NUMBER ASSIGNED TO GROUND TRACK
C      ORGSTR - WHERE PROCEDURE STARTS
C      ORGEND - WHERE PROCEDURE ENDS
C     S - RESTRICTION START
C  ALTRRD - SUBROUTINE
C  ALTRRD IS USED TO DECIPHER THE OPTIONAL NOISE ABATEMENT TAKE OFF
C  PROCEDURES FROM THE INPUT DATA AND SUBSEQUENT INITIALIZATION OF
C  ASSOCIATED VARIABLES.
C  ALTRRD USES EXTERNAL SUBROUTINES MESAGE AND SETRES.
C  THE SUBROUTINE ALTRRD HAS ONLY ENTRY POINT AND THE CALLING SEQUENCE
C  IS AS FOLLOWS:
C  CALL ALTRRD (*,NR,IDUMP)
C  WHERE
C  *  -MEMORY ADDRESS OF ERROR RETURN
C  NR  -ERROR INDICATOR WHICH IF NOT EQUAL TO ZERO MEANS AN ERROR HAS
C  BEEN DETECTED
C  IDUMP-PASSED TO SUBROUTINE SETRES AS A DIAGNOSTIC OUTPUT FLAG.
C  THE SUBROUTINE ALTRRD IS USED BY ONLY ONE PROGRAM, SUBROUTINE READIN
C  AND WILL NORMALLY, ALTHOUGH NOT NECESSARILY, BE CALLED ONCE DURING
C  THE INPUT PHASE OF EXECUTION.
C  ALTRRD RECEIVES ALL OF ITS INPUT DIRECTLY FROM INPUT DATA CARDS.
C  THERE ARE TWO EXIT RETURNS FROM SUBROUTINE ALTRRD.  THESE ARE AT
C  LINES NUMBERED 60 AND 61 OF THE SUBROUTINE LISTING IN SECTION 5.
C  THE RETURN AT LINE 60 IS AN ERROR RETURN TO READIN WHICH WILL CAUSE
C  THE RUN TO BE TERMINATED IMMEDIATELY.  THE RETURN AT LINE 61 IS THE
C  NORMAL RETURN.
C  WHILE ALTRRD PERFORMS NO COMPUTATIONAL PROCESSING, SEVERAL TABLES IN
C  LABELED COMMON BLOCK/RESALT/ARE INITIALIZED AS FOLLOWS:
C  ICBT  -CONTAINS THE TYPE OF NOISE ABATEMENT PROCEDURE.
C  GCRN  -CONTAINS THE INPUT TAKEOFF GRADIENT
C  ORGSTR  -CONTAINS THE DEFINITION OF WHERE THE PROCEDURE STARTS
C  ORGEND  -CONTAINS THE DEFINITION OF WHERE THE PROCEDURE ENDS
C  NAR  -CONTAINS THE PROCEDURE NUMBER ASSIGNED TO EACH GROUND TRACK.
```

Subroutine APPTRD

```
      SUBROUTINE APPTRD(IGO,ICNT)                                    03-14-79
C                                                                    03-28-79
C          LOCAL VARIABLE DICTIONARY                                 03-28-79
C                                                                    03-28-79
C   DUM  - USED TO STORE APPROACH PARAMETERS TEMPORARILY             03-28-79
C   I    - ORDINAL APPROACH PARAMETER I.D. NUMBER                    03-28-79
C   K    - ACTUAL APPROACH PARAMETER I.D. NUMBER                     03-28-79
C          GT 100 - NEW                                              03-28-79
C          LT "MAXAPP" - EXISTS ON DATA BASE (REPLACEMENT)           03-28-79
C
```

Function ASDS2

```
      FUNCTION ASDS2 (ITAC,KX)
C
C     ***************************************************************

C     LOCAL VARIABLE DICTIONARY

C     ATH - WORD 1 IS USER DEFINED THRESH MINUS 5 DB, WORD 2
C                IS USER DEFINED THESHOLD AS INPUT
C     ASTIMS - TIMES ABOVE THRESHOLD VALUES IN MINUTES
C     ASD,
C     ASDMN - DISTANCE FROM RUNWAY THRESHOLD TO START OF A/C TRACKING
C                ALONG GROUND TRACK
C     ASDMX - DISTANCE FROM RUNWAY THRESHOLD TO END OF A/C TRACKING
C                ALONG GROUND TRACK
C     ASTAMS - RUNNING TOTALS OF TIMES ABOVE THRESHOLDS
C     ASTMN - SEE ASDMN
C     ASTMX - SEE ASDMX
C     ASDS2 - THE VALUE OF THE ASDS METRIC FOR THIS FLIGHT AND THRESHOLD
C     ASDS3 - (EXPOSURE) DOSAGE FOR THIS FLIGHT AND THRESHOLD
C     ASDST - TIME ABOVE THRESHOLD IN SECONDS
C     ASPROF - TABLE OF AIRCRAFT PERFORMANCE PROFILES
C     CONCRN - TABLE OF CUTOFF DISTANCES FOR NOISE CONTRIBUTION
C     DTHRESH - TABLE OF DEFAULT THRESHOLDS MINUS 5 DB
C     D - TOTAL OPERATIONS FUDGED TO OPS PER MINUTE
C     DD - USER DEFINED DOSE TIMES (UNITS NEED NOT BE MINUTES...)
C     DINT - INITIAL TIME STEP EQUALS DMINT
C     F - OPERATIONS DIVIDED BY SIX TENTHS FOR UNKNOWN REASON
C     I - THRESHOLD NUMBER
C     IGO - ERROR RETURN
C     ITAC - NOISE CURVE SET NUMBER FOR THIS FLIGHT
C     ITACTP - A/C TYPE FOR TIHIST RETRIEVED AS MTCHAC(ITAC),LOCAL VAR
C     IVX - ASSIGNED LOCAL VARIABLE
C     J - OBSERVER NUMBER
C     KX - NUMBER OF POSITION OF FLIGHT DEFINITION IN TABLE ITPRAC
C                IN LABELLED COMMON BLOCK /TRAFIK/
C     LDBTI - LOGICAL FLAG, TRUE PRODUCES DIAGNOSTIC PRINTOUT
C     MTCHAC - TABLE OF A/C TYPES FOR TIHIST
C     MTHN - NUMBER OF ASDS2 (DOSE) THRESHOLDS
C     NOBS - NUMBER OF OBSERVERS
C     NPS - NUMBER OF PROFILE SEGMENTS
C     NSEGS - NUMBER OF SEGMENTS IN THE PERFORMANCE PROFILE
C     NTI - NUMBER OF THRESHOLD VALUES
C     OPS - WEIGHTED NUMBER OF OPERATIONS FOR EACH FLIGHT FOR ALL METRICS
```

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C      PR -
C      SLR - SLANT RANGE
C      SCMEND - MAXIMUM DISTANCE FROM AIR
C      SCMENC - MAXIMUM DISTANCE FROM AIRCRAFT ABOVE WHICH FURTHER COMPUTATIONS
C                 WILL NOT BE PERFORMED
C      TH2 - USERS ASDS2 THRESHOLD
C      TH2 - USERS
C      THE - USER  ASDS2 (DOSE) THRESHOLDS
C      TI - SAME AS TOR
C      TORL - TAKEOFF OR LANDING FLAG, POS IS TAKEOFF, NEG LANDING, VALUE 1.
C  ASDS2 - FUNCTION SUBROUTINE
C  THE FUNCTION SUBROUTINE ASDS2 IS RESPONSIBLE FOR CONTROLLIN THE
C  DETERMINATION OF THE ASDS EXPOSURE VALUE FOR A SPECIFICALLY DEFINED
C  FLIGHT INCLUDING ALL OPERATIONS FOR THE FLIGHT.  THE SUBROUTINE
C  TIHISI IS CALLED TO DETERMINE THE EXPOSURE FOR A SINGLE OPERATIONS.
C  THE FUNCTION ASDS2 IS CALLED BY FUNCTION SUBROUTINES ACHOIS AND
C  EXPOSE AT THE ASDS2 ENTRY POINT.  THE CALLING SEQUENCE FOR ASDS2 IS
C  AS FOLLOWS:
C  ASDS2 (ITRC, KX)
C  WHERE
C  ITRC  -NOISE CURVE SET NUMBER CORRESPONDING TO THIS FLIGHT.
C  KX  -THE NUMBER OF THE POSITION OF THE FLIGHT DEFINITION IN LABELED
C  COMMON BLOCK/TRAFIK/, TABLE ITRAC.
C  OTHER INPUT TO FUNCTION ASDS2 IS PROVIDED IN LABELED COMMON BLOCKS
C  /PROFNI/,/TRAFIK/AND/ASDS23/.  THE FOLLOWING WILL DESCRIBE THE
C  PERTINENT INFORMATION IN THOSE BLOCKS.
C  COMMON BLOCK      TABLE      DESCRIPTION
C  /PROFNI/          ASPROF     PERFORMANCE PROFILE FOR THIS FLIGHT.
C                    NSEGS      NUMBER OF SEGMENTS IN THE PERFORMANCE
C  "                            PROFILE.
C                    TORL       INDICATES TAKEOFF OF LANDING OPERATION.
C                               A VALUE OF +1.0 INDICATES TAKEOFF, -1.0
C                               INDICATED LANDING.
C                    SLR        DISTANCE FROM THE ANALYSIS POINT TO THE
C                               AIRCRAFT AT THE POINT OF CLOSEST
C                               APPROACH.
C  /TRAFIK/          OPS        CONTAINS THE WEIGHTED NUMBER OF
C                               OPERATIONS FOR EACH INDIVIDUALLY DEFINED
C                               FLIGHT FOR ALL METRICS.  LEQ, ASDS AND
C                               DOSE HAVE THE SAME WEIGHTING SO THE
C                               OPERATIONS FOR THE CURRENT FLIGHT CAN BE
C                               FOUND AT OPS (KX,4).
C  COMMON BLOCK      TABLE      DESCRIPTION
C  /ASDS23/          TH2        USER DEFINED ASDS THRESHOLD
C                    NTH        NUMBER OF DOSE THRESHOLDS
C                    TH2        USER DEFINED DOSE THRESHOLDS
C                    T2         USER DEFINED DOSE TIMES
C  THERE ARE TWO NORMAL EXIT RETURNS FROM ASDS2 AND ONE EXIT
C  TERMINATION.  THE TWO NORMAL EXIT RETURNS ARE AT LINES NUMBERED 88
C  AND 167 IN THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT LINE
C  167 IS USED WHEN THE VARIABLE SLR IS OF SUFFICIENT MAGNITUDE THAT
C  TIHISI NEED NOT BE CALLED AND THE VALUE OF ASDS FOR THIS FLIGHT IS
C  IDENTICALLY ZERO.  THE EXIT AT LINE 96 (STATEMENT NUMBER 30)
C  TERMINATES ANY FURTHER EXECUTION AFTER AN ERROR CONDITION HAS BEEN
C  ENCOUNTERED IN THE SUBROUTINE TIHISI.  THIS EXIT IS COMMON TO BOTH
C  THE ASDS2 AND ASDS3 FUNCTIONS.
C  THE VALUE OF ASDS FOR THIS FLIGHT IS RETURNED FOR THE USER DEFINED
C  THRESHOLD THROUGH THE FUNCTION NAME.  THE VALUES OF ASDS FOR A
C  THRESHOLD 5 DB BELOW THE USER DEFINED THRESHOLD AS WELL AS THE USER
C  DEFINED THRESHOLD ARE SUMMED CUMULATIVELY IN THE FIRST TWO LOCATIONS
C  OF TABLE ASDAMS IN LABELED COMMON BLOCK/GRDBLK/.  THE RESULTS ARE
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C  RETURNED IN TERMS OF MINUTES ABOVE THRESHOLD.
C  THE PROCESSING PERFORMED BY ASDS2 CONSISTS OF INITIALIZING VARIABLES
C  FOR THE CALL TO TIHIST AND CONVERTING THE RESULTS OF THE COMPUTATION
C  PERFORMED BY TIHIST TO MINUTES FROM SECONDS.  THE FOLLOWING ARE THE
C  VARIABLES INITIALIZED AND THEIR VALUES.
C  VARIABLE      VALUE/DEFINITION
C  NTH           NUMBER OF THRESHOLD VALUES = 2
C  ATH (1)       USER DEFINED THRESHOLD MINUS 5 DB
C  ATH (2)       USER DEFINED THRESHOLD
C  ISPROF        AIRCRAFT PERFORMANCE PROFILE
C  NPS           NUMBER OF PROFILE SEGMENTS
C  VARIABLE      VALUE/DEFINITION
C  TL*           SAME AS TOPL (SEE COMMON BLOCK DESCRIPTIONS)
C                COMPUTATIONS WILL NOT BE PERFORMED.
C  SOMEXT*       MAXIMUM DISTANCE FROM AIRCRAFT ABOVE WHICH FURTHER
C  SMINT*        MINIMUM TIME STEP CALCULATED  MAX. OF (1, 2.) WHERE A=
C                1+ (SL2-1000)/10000 MIN. OF (ABOVE RESULT, 10. ,
C                SMEXT/2
C  SINT*         INITIAL TIME STEP = SMINT
C  ITACT2*       AIRCRAFT TYPE FOR TIHIST RETRIEVED AS MTCHAC (ITAC),
C                A DOCK VARIABLE.
C  *INITIALIZED ROUTINELY FOR ASDS2 AND ASDS3 CALLS.
C  ASDS3 - FUNCTION SUBROUTINE (ENTRY IN ASDS2)
C  THE FUNCTION SUBROUTINE ASDS3 IS AN ALTERNATE ENTRY POINT IN THE
C  FUNCTION SUBROUTINE ASDS2 AND COMPUTES THE DOSE EXPOSURE VALUE FOR
C  ONE FLIGHT.  SUBROUTINE TIHIST IS CALLED TO DETERMINE THE TIME ABOVE
C  THRESHOLDS AND ASDS2 CONVERTS THESE TO DOSE BY THE FOLLOWING:
C  DOSE(I)=A(2)*(T(1(/D(1) + T(2)/D(2)  + 000 + T(M)/D(M))*100
C  WHERE
C  IF  MI=THE NUMBER OF OPERATIONS IN FLIGHT I
C  TJ=USER-DEFINED TIME ABOVE THRESHOLD J IN MINUTES
C  TJ=COMPUTED TIME ABOVE THRESHOLD J IN MINUTES
C  DOSE I = EXPOSURE CONTRIBUTION OF FLIGHT I IN PERCENT
C  ASDS3 IS CALLED BY THE SAME SUBROUTINE AS ASDS2.
C  THE CALLING SEQUENCE FOR ASDS3 IS:
C  ASDS3 (ITAC, XX)
C  WHERE THE ARGUMENTS ITAC AND XX ARE AS DEFINED FOR ASDS2.  THE INPUT
C  VARIABLES ARE, LIKEWISE, AS DEFINED FOR ASDS2.
C  ASDS3 HAS ONE EXIT RETURN AND ONE EXIT TERMINATION IN COMMON WITH
C  ASDS2 AT LINES NUMBERED 195 AND 96, RESPECTIVELY IN THE LISTING, AND
C  THEY ARE BOTH USED FOR THE SAME REASONS AS DESCRIBED FOR ASDS2.
C  THERE IS AN ADDITIONAL EXIT RETURN FOR ASDS3 AT LINE NUMBER 152.
C  THIS RETURN IS USED AFTER A SUCCESSFUL CALL TO TIHIST.
C  THE DOSE VALUE FOR THE CURRENT FLIGHT IS RETURNED TO THE CALLING
C  PROGRAM VIA THE FUNCTION NAME.  THE CUMULATIVE SUM FOR ALL FLIGHTS
C  IS RETURNED AS THE FIRST VALUE OF ASRANS.
C  IN ADDITION TO THE COMPUTATION OF THE DOSE VALUE, SEVERAL VARIABLES
C  ARE INITIALIZED, SOME OF WHICH HAVE BEEN DESCRIBED IN THE ASDS2
C  DISCUSSION, SUBSEQUENT TO EACH CALL TO ASDS3.  THOSE WHICH DIFFER
C  FROM THE ONES DESCRIBED EARLIER ARE:
C  VARIABLE      VALUE/DEFINITION
C  NTH           NUMBER OF THRESHOLDS=NZTH
C  ATH           USER DEFINED DOSE THRESHOLDS
C
```

Function ASDS2G

```
      FUNCTION ASDS2G (ITAC,KX)
C
C     ******************************************************************
C
C      LOCAL VARIABLE DICTIONARY
C      V - OPS BY SECONDS
C
C      AS2MH - DISTANCE FROM RUNWAY THRESHOLD TO START OF A/C TRACKING
C                ALONG GROUND TRACK
C      AS2MX - DISTANCE FROM RUNWAY THRESHOLD TO END OF A/C TRACKING
C                ALONG GROUND TRACK
C      ASPMH - SEE AS2MH
C      ASPMX - SEE AS2MX
C      ASDS2G - ASDS EXPOSURES FOR GRID OUTPUT
C      ASDS2I - TIME ABOVE SIX THRESHOLDS FOR THREE DEFINED TIME PERIODS
C      ASDS2P - CUMULATIVE SUMMATION OF THE ASDS2I VALUES
C      ASDS2T - TIMES ABOVE THRESHOLD VALUES IN SECONDS
C      ASPROF - PERFORMANCE PROFILE FOR THIS FLIGHT
C      B - DIFFERENCE BETWEEN EVENING AND NIGHT OPS PER SECONDS
C      B - DIFFERENCE BETWEEN EVENING AND NIGHT OPS TIME UNITS ARE SECONDS
C      C - DIFFERENCE BETWEEN DAY AND EV
C      C - DIFFERENCE BETWEEN DAY AND NIGHT (NOT EVENING) OPERATIONS, AGAIN
C                TIME UNITS ARE SECONDS
C      CONCEN - TABLE OF CUTOFF DISTANCES FOR NOISE CONTRIBUTION
C      CTRESH - TABLE OF VALUES 5 DB LESS THAN THE DEFAULT THRESHOLDS
C      D -B ASDS VALUES INCREMENTAL BY FLIGHT SEGMENT
C      DS - USER DEFINED DOSE TIME UNITS
C      DTNT - INITIAL TIME STEP INTVLS DMINT
C      DMAXT -MAXIMUM ACCEPTABLE TIME STEP
C      E - HAHA
C      ICD - ERROR RETURN
C      ITAC - NOISE CURVE SET NUMBER FOR A/C FOR FLIGHT
C      ITACTP - A/C TYPE FOR TIHISI RETRIEVED AS MTCHAC(ITAC),LOCAL VAR
C      IVX - ASSIGNED LABEL
C      KX - POS OF DEPN OF THIS FLIGHT IN TABLE ITPRAC
C      LDETI - LOGICAL FLAG, TRUE MEANS PRODUCE DIAGNOSTIC OUTPUT
C      MTCHAC - TABLE OF A/C TYPES FOR TIHISI
C      NOTH - NUMBER OF THRESHOLDS
C      NPS - NUMBER OF PROFILE SEGMENTS
C      NS - SAME AS TORI
C      TORI - INDICATES TAKEOFF OR LANDING, AS PLUS OR MINUS ONE
C  ASDS2G - FUNCTION SUBPROGRAM
C  THE FUNCTION SUBROUTINE ASDS2G IS RESPONSIBLE FOR CONTROLLING THE
C  DETERMINATION OF THE ASDS EXPOSURE VALUES FOR A SPECIFICALLY DEFINED
C  FLIGHT, INCLUDING ALL OPERATIONS FOR THE FLIGHT.
C  ASDS2G CALLS THE SUBROUTINE TIHISI.
C  THERE ARE TWO ENTRY POINTS TO ASDS2G AT THE NAMES ASDS2G AND ASDS3G.
C  THE CALLING SEQUENCE FOR ASDS2G IS:
C  ASDS2G(ITAC,KX)
C  WHERE
C  ITAC - THE NOISE CURVE SET NUMBER ASSIGNED TO THE AIRCRAFT FOR THIS
C  FLIGHT.
C  KX - THE POSITION OF THE DEFINITION OF THIS FLIGHT IN THE TABLE
C  ITPRAC (THE FLIGHT DEFINITION TABLE).
C  EXPOSG IS THE ONLY SUBROUTINE TO CALL ASDS2G.
C  THE INPUT TO ASDS2G, WITH THE EXCEPTION OF THE VARIABLE TH2, IS THE
C  SAME AS FOR ASDS2 WITH THE ADDITIONAL INPUT FROM LABELED COMMON
```

```
C  BLOCK/GRD2BK/ HAVING THE VARIABLE ASDS2T WHICH CONTAINS THE SIX
C  NOISE LEVEL THRESHOLDS FOR WHICH THE TIME ABOVE IS TO BE COMPUTED.
C  THERE ARE TWO EXIT RETURNS AND ONE EXIT TERMINATION FROM ASDS2G,
C  LOCATED AT LINES NUMBERED 87, 87 AND 101 IN THE SUBROUTINE LISTING
C  INSPECTION 5.  THE RETURN AT LINE 87 IS A NORMAL RETURN AFTER
C  COMPUTATIONS HAVE BEEN COMPLETED.  THE EXIT AT LINE 87 CAUSES
C  IMMEDIATE TERMINATION OF EXECUTION AND IS USED IF ERROR ARE ENCOUNT-
C  ERED IN THIS.  THE RETURN AT LINE 101 IS A NORMAL RETURN AND IS
C  USED WHEN ASDS2G DETERMINES THAT THE LOWEST THRESHOLD WILL NEVER BE
C  EXCEEDED BY THE FLIGHT IN QUESTION AT THE POINT BEING ANALYZED AND
C  ALL INDIVIDUAL TIMES ARE SET TO ZERO.  NOTE THAT THE RETURNS AT
C  LINES 87 AND 101 ARE COMMON TO BOTH ASDS2G AND ASDS3G.
C  THE OUTPUT FROM ASDS2G IS PASSED TO THE CALLING THROUGH THE FUNCTION
C  NAME AND LABELED COMMON BLOCK/GRDOUT/ WHOSE VARIABLES ARE DESCRIBED
C  AS FOLLOWS:
C  VARIABLE              DESCRIPTION
C  ASDS2P      CUMULATIVE SUMMATION OF THE TIME ABOVE SIX THRESHOLDS FOR
C              THREE DEFINED TIME PERIODS, UP TO AND INCLUDING THIS
C              FLIGHT.
C  ASDS2I      THE TIME ABOVE SIX THRESHOLDS FOR THREE DEFINED TIME
C              PERIODS, FOR THIS FLIGHT ONLY.
C  OTHERS      VALUES FOR THE OTHER FIVE METRICS-NEF,LDN,CNEI,LEQ, AND
C              DOSE-IN THAT ORDER.
C  THE THREE TIME PERIODS MENTIONED IN THE ABOVE DEFINITIONS CORRESPOND
C  TO THE FOLLOWING HOURS IN A CALENDAR DAY:
C  DAY  -  0000 TO 2400
C  EVENING - 1900 TO 2200
C  NIGHT  -  0000 TO 0700 AND 2200 TO 2400
C  THE PROCESSING PERFORMED BY ASDS2G, OTHER THAN INITIALIZING
C  VARIABLES, CONSISTS OF COMPUTING THE TIMES ABOVE THE SIX THRESHOLDS
C  FOR THE ABOVE TIME PERIODS FOR ALL THE OPERATIONS DEFINED FOR THIS
C  FLIGHT, GIVEN THE TIMES ABOVE FOR ONE SUCH FLIGHT.  ADDITIONALLY,
C  THE TIMES ABOVE THE THRESHOLDS MUST BE CONVERTED FROM SECONDS TO
C  MINUTES.
C
```

Subroutine ASD2TH

```
      SUBROUTINE ASD2TH (IGO)

C       LOCAL VARIABLE DICTIONARY

C       D1 - THRESHOLD TOLERANCES (ACCEPTABLE CONTOUR VARIATION)

C       I - LOOP COUNTER
C       ICMT - USER TITLE

C       IGO - ERROR FLAG
C       J - LOOP COUNTER
C       NUTH - NUMBER OF THRESHOLD VALUES
C       TH - FIRST USER SPECIFIED THRESHOLD
C       TH2 - USER SPECIFIED THRESHOLDS (2 - 20)
C
C     **********************************************************************
C  ASD2TH - SUBROUTINE
C  ASD2TH READS THE ASDS THRESHOLD VALUE FROM THE INPUT DATA.
C  NO EXTERNAL SUBROUTINES ARE USED BY ASD2TH.
C  THE SUBROUTINE ASD2TH HAS FOUR ENTRY POINTS, ASD2TH, ASD3TH, ASDANC
C  AND ASDCOF.  ALL HAVE THE SAME CALLING SEQUENCE AS FOLLOWS:
C  CALL ASDXXX(*)
C  WHERE
```

```
C  * - MEMORY LOCATION FOR ERROR RETURN.
C  YXX - 2TH, 3TH, ANC OR CON AS REQUIRED FOR DESIRED ENTRY.
C  NOTE THAT THE ENTRIES ASDANC AND ASDCON ARE NOT USED AT THIS TIME
C  BUT ARE INCLUDED FOR LATER UPGRADING OF THE PROGRAM.  CALLS USING
C  THESE ENTRY POINTS WILL CAUSE AN IMMEDIATE ERROR RETURN WHICH WILL
C  TERMINATE EXECUTION.
C  THE ENTRY ASD2TH IS NORMALLY CALLED ONLY ONCE PER RUN BUT AT THE
C  USERS DISCRETION MAY BE CALLED MORE THAN ONCE, BUT ONLY THE
C  THRESHOLD READ DURING THE FINAL CALL WILL BE USED.
C  ASD2TH HAS 2 EXIT RETURNS AT LINES NUMBERED 9 AND 11 IN THE
C  SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT LINE NUMBER 9 IS AN
C  ERROR RETURN AND IS USED IF THE USER DEFINED ASDS THRESHOLD IS LESS
C  THAN 64 DB OR GREATER THAN 115 DB.  EXECUTION WILL BE TERMINATED IF
C  THIS RETURN IS USED.  THE NORMAL RETURN IS AT LINE 11 AND IS USED
C  IF THE RETURN AT LINE 9 IS NOT USED.
C  THE VARIABLE TH2 IN LABELED COMMON BLOCK/ASDS23/IS SET EQUAL TO THE
C  USER DEFINED THRESHOLD VALUE.
C  THE ASD3TH ENTRY IS CALLED ONLY BY SUBROUTINE READIN DURING THE
C  INPUT PHASE.  NORMALLY, ASD3TH IS CALLED ONLY ONCE SINCE ONLY THE
C  LAST OF MULTIPLE CALLS WOULD BE EFFECTIVE.
C  ASD3TH HAS FOUR EXIT RETURNS AT LINES NUMBERED 19, 25, 26 AND 28.
C  THE RETURN AT LINE 19 IS AN ERROR RETURN AND IS USED IF THE NUMBER
C  OF THRESHOLDS REQUESTED BY THE USER IS NOT BETWEEN THE NUMBERS 0 AND
C  20.  THE RETURN AT LINE 25 IS AN ERROR RETURN AND IS USED IF ANY OF
C  THE INPUT THRESHOLDS IS LESS THAN 64 OR GREATER THAN 115 DB.  THE
C  RETURN AT LINE 26 IS AN ERROR RETURN AND IS USED IF ANY OF THE USER
C  DEFINED TIME ABOVE THRESHOLD IS LESS THAN OR EQUAL TO ZERO MINUTES.
C  ALL ERROR RETURNS WILL RESULT IN EXECUTION TERMINATION.  THE NORMAL
C  RETURN IS AT LINE 28.
C  ASD3TH READS ITS DATA FROM THE INPUT DATA CARDS AND INITIALIZES THE
C  VARIABLES N3TH, TH3 AND D3 IN LABELED COMMON BLOCK/ASDS23/.
C
```

Subroutine ATA

```
C     SUBROUTINE ATA(PROF,I,K)                                          03-08-79
C                                                                       03-08-79
C SUBROUTINE ATA HANDLES THE SIMULATION OF THE ATA TAKEOFF PROCEDURE.    03-08-79
C THIS IS ACCOMPLISHED BY THE TRANSPOSITION OF THE ACCELERATION SEGMENT 03-08-79
C FROM INITIALIZATION AT 3000 FT. AGL TO INITIALIZATION AT 1000 FT. AGL.03-08-79
C ONLY THE SET OF COMMERCIAL JETS ARE IMPACTED BY THE OPERATION OF THIS 03-08-79
C SUBROUTINE.  THE PROGRAMMER WAS THOMAS I. CONNOP, AEE-110, JANUARY,   03-08-79
C 1979.                                                                 03-08-79
C     VARIABLES:                                                        03-08-79
C       PROF=ARRAY CONTAINING THE PARAMETERS OF A TAKEOFF PROFILE;      03-08-79
C           GROUND DISTANCE,ALTITUDE,THRUST AND SPEED.                  03-08-79
C       I=PROFILE NUMBER                                                03-08-79
C       K=AIRCRAFT TYPE NUMBER                                          03-08-79
C       ACCSPD=ARRAY CONTAING THE ZERO FLAPS SPEED                      03-08-79
C       VZF=ZERO FLAPS SPEED                                            03-08-79
C       ACCDST=TOTAL LENGTH OF ACCELERATION SEGMENT                     03-08-79
C       ACCALT=CHANGE IN ALTITUDE IN ACCELERATION SEGMENT               03-08-79
C       FCLMB=FINAL CLIMB GRADIENT                                      03-08-79
C       FTHRST=FINAL CLIMBOUT THRUST                                    03-08-79
C                                                                       03-08-79
```

Function ATTENG

```
      FUNCTION ATTENG (XX,Z,ITAC,PWR,V)

C     ********************************************************************

C     COMPUTES GROUND ATTENUATION PER SAE AIR923 )SIMPLIFIED(
C     ALSO COMPUTES ENGINE SHIELDING AND VELOCITY CORRECTIONS.
C      LOCAL VARIABLE DICTIONARY
C     B- ELEVATION ANGLE, DIFFERENT AXIAS
C      ATTENG - SUM OF VELOCITY SHIELDING AND GROUND ATTENUATION CORRECTIONS
C                 (RETURNED)
C     BETA - ELEVATION ANGLE
C      BX - INTERPOLATION POINT (SLANT RANGE) IN TABLE OF GROUND ATTENUATION
C     GNDATT - ATTENUATION AT GIVEN POINT )INTERPOLATED(
C      GRNDA - TABLE OF GROUND ATTENUATIONS (BY ASCENDING VALUES OF SLRNG)
C      I - INDEX OF LARGEST VALUE IN GRNDA LESS THAN GNDATN
C     ITAC - AIRCRAFT TYPE
C      N - NUMBER OF POINTS IN TABLE OF ATTENUATIONS
C     PWR - POWER SETTING
C      SLRNG - TABLE OF SLANT RANGES (ASCENDING ORDER)
C      V - VELOCITY
C      X - HORIZONTAL DISTANCE TO FLIGHT GROUND TRACK.
C      Z - AIRCRAFT HEIGHT ABOVE RUNWAY
C  ATTENG - FUNCTION SUBROUTINE
C  FUNCTION ATTENG COMPUTES THE VELOCITY CORRECTION, ENGINE SHIELDING
C  CORRECTION, AND EXCESS GROUND ATTENUATION CORRECTION FOR THE SINGLE
C  EVENT NOISE COMPUTATIONS ASSOCIATED WITH THE NEF, LDN, CNEL, AND LEQ
C  METRICS.
C  ATTENG USES THE FUNCTION SUBROUTINE GENFNC FOR INTERPOLATION PURPOSES.
C  THE SUBROUTINE ATTENG HAS ONLY ONE ENTRY POINT AND THE CALLING
C  SEQUENCE IS:
C  ATTENG (X, Z, ITAC, POR, V)
C  WHERE
C  X - HORIZONTAL DISTANCE TO THE FLIGHTS GROUND TRACK
C  Z - AIRCRAFT HEIGHT ABOVE RUNWAY LEVEL
C  ITAC - NOISE CURVE NUMBER ASSOCIATED WITH THE AIRCRAFT FOR THIS
C  FLIGHT
C  PWR - AIRCRAFT THRUST SETTING IN POUNDS PER ENGINE
C  V - AIRCRAFT VELOCITY IN KNOTS
C  EXPOSE IN THE ONLY SUBROUTINE THAT CALLS ATTENG.
C  ATTENG RECEIVES ITS INPUT DATA FROM THE CALLING ARGUMENTS AS WELL AS
C  TABLES SLRNG AND GRNDA IN LABELED COMMON BLOCK/NOISE/.
C  ATTENG HAS FOUR EXIT RETURNS AT LINES NUMBERED 17, 23, 28 AND 30 IN
C  THE SUBROUTINE LISTING IN SECTION 3.  THE RETURN AT LINE 17 IS USED
C  IF THE SHIELDING AND GROUND ATTENUATION CORRECTION VALUES NEED NOT
C  BE COMPUTED DUE TO THE PROXIMITY OF THE ANALYSIS POINT TO THE GROUND
C  TRACK (I.E., THE AIRCRAFT IS DIRECTLY OVERHEAD).  THE RETURN AT LINE
C  23 IS USED IF THE ELEVATION ANGLE AT THE OBSERVER POINT BETWEEN THE
C  GROUND PLANE AND THE AIRCRAFT IS GREATER THAN 10 (0.17453 RADIANS).
C  THE RETURN AT LINE 28 IS USED IF THE COMPUTED VALUE FOR GROUND
C  ATTENUATION IS LESS THAN OR EQUAL TO ZERO.  THE RETURN AT LINE 30
C  IS USED IF NONE OF THE OTHERS ARE USED.
C  ATTENG COMPUTES THE VELOCITY SHIELDING AND GROUND ATTENUATION
C  CORRECTION VALUES FOR A GIVEN FLIGHT AND RETURNS THE RESULT AS THE
C  SUM OF THEM ALL VIA THE FUNCTION NAME.
      COMMON/NOISE/SLRNG(9),GRNDA(9),GNDATN,BX,N,I
```

Subroutine BDATA

```
      SUBROUTINE BDATA(DUM)                                              TEMP
C     BLOCK DATA                                                         TEMP
C     ******************************************************************
C
C        MASK CONTAINS BINARY MASKING CONSTANTS USED FOR GENERATING
C
C
C      MASKING SCHEME FOR VARIABLE "ITPRAC" IN VERSION 2:                03-30-79
C                                                                        03-30-79
C    BITS  0 -  5     APPROACH PARAMETER I.D. (ORDINAL)                  03-30-79
C    BITS  6 - 10     NOISE CURVE I.D. (ORDINAL)                         03-30-79
C    BITS 11 - 18     PROFILE I.D. (ORDINAL)                             03-30-79
C    BITS 19 - 25     TRACK NUMBER                                       03-30-79
C    BITS 26 - 30     TRACK GROUP NUMBER                                 03-30-79
C                                                                        03-30-79
C      MASK(18) - MASK(22) ARE USED TO EXTRACT THIS INFORMATION          03-30-79
C                                                                        03-30-79
```

Subroutine CHEKTHR

```
      SUBROUTINE CHEKTHR(IGO)                                            03-20-79
C THIS SUBROUTINE COMPARES SAMPLE THRUST SETTINGS SPECIFIED IN THE DATA   03-05-79
C BASE AND BY THE USER FOR COMPATIBILITY. THESE SETTINGS ARE FOUND IN     03-05-79
C THE MAXIMUM AND MINIMUM NOISE CURVE THRUST SPECIFICATIONS-              03-05-79
C ARRAY "PWRES", IN THE APPROACH PARAMETER DATA- ARRAY "APPTHR", AND      03-05-79
C IN THE STORED TAKEOFF PROFILES- ARRAY "PROF".                          03-05-79
C A FATAL ERROR MESSAGE IS ISSUED IF THE FOLLOWING INEQUALITIES ARE       03-20-79
C VIOLATED:                                                              03-05-79
C    USE CRV MIN -20 PERC. (LT) APP. THRST. -3 (LT) USE CRV MAX          03-20-79
C                                                                        03-05-79
C    USE CRV MIN (LT) T.O. THRUSTS (LT) USE CRV MAX + 20 PERC.           03-05-79
C                                                                        03-05-79
C AND IF AN AIRCRAFT IS DEFINED WITH A CONFLICTING NO.                   03-25-79
C OF ENGINES                                                             03-25-79
```

Subroutine CKBETW

```
      SUBROUTINE CKBETW (A,VA1,B,VB,LL,VMIN,VMAX,NPTS)
C
C     ******************************************************************
C      LOCAL VARIABLE DICTIONARY
C      A - EXPOSURE AT VA1
C      B - EXPOSURE AT VB
C      C - SCRATCH VARIABLE USED FOR EXPOSURE DIFFERENCES, RATIOS, ETC
C      DELS - MAXIMUM STEPSIZE BETWEEN POINTS
C      E - WORKING EXPOSURE
C      F - WORKING EXPOSURE
C      G - WORKING EXPOSURE
C      LL - RETURN VARIABLE FOR STATUS OF CONDIDATE POINT,NONZERO I NO GOOD
C      NPTS - NUMBER OF POINTS IN CONTOUR
C      PZ CONDIDATE CONTOUR POINT
C      TOL - CONTOUR TOLERANCE
C      TOL2 - CONTOUR TOLERANCE , NEVER CLOBBERED
C      TOLLOP - PROXIMITY TO CONTOUR FACTOR FOR LOOP CHECK COMPUTATION
C      VA1 - VECTOR ORIGIN TO FIRST OF BRACKETING POINTS
C      VAT - CONTOUR VALUE
```

```
C      VB - VECTOR ORIGIN TO SECOND OF BRACKETING POINTS
C      VE - WORKING VECTOR
C      VG - WORKING VECTOR
C      VMAX - MAXIMUM ACCEPTABLE EXPOSURE VALUE (CONTOUR LEVEL PLUS TOL)
C      VMIN - MINIMUM ACCEPTABLE EXPOSURE VALUE (CONTOUR LEVEL MINUS TOL)
C      VST - RESULTANT OF VE MINUS VG
C      VTEM - SCRATCH COPY OF VE
C      X - X COORDS OF PREVIOUSLY COMPUTED CONTOUR POINTS
C      Y - Y COORDS OF PREVIOUSLY COMPUTED CONTOUR POINTS
```

Subroutine CKLOOP

```
      SUBROUTINE CKLOOP (RIP,M,NPTS,X,Y,DELS,TOL2,TOLLOP)

C     ***************************************************************

C      LOCAL VARIABLE DICTIONARY

C     DELS - STEP SIZE
C      DLIM - DISPLACEMENT ANGLE (TOLERABLE BETWEEN SUCCESSIVE POINTS)
C      I - LOOP COUNTER
C      M - YES, IT IS LOOPING
C      NPTS - TOTAL POINTS IN CONTOUR LESS LATEST THREE
C      NPTS - NUMBER OF POINTS IN CONTOUR
C      PD - NORMALIZED DOT PRODUCT OF RP,PR OR RP,RR
C      PP - AS RP, OPPOSITE DIRECTION
C      PRMAG - LENGTH OF RP (YES, THATS RP)
C      PIN - NEW (CURRENT) POINT
C       RP - DIFFERENCE VECTOR BETWEEN A GIVEN AND NEXT PREVIOUS POINTS
C      PR - DIFFERENCE VECTOR BETWEEN NEW AND A GIVEN POINTS
C     TOL2 - STEPDEVIATION TOLERANCE
C     TOLLOP - STEP DEVIATION TOLERANCE
C     ROUTINE CHOOSES MINIMUM OF TOL2, TOLLOP
C     V - CONTOUR COORDINATES
C     V - CONTOUR COORDINATES
C   CKLOOP - SUBROUTINE
C   THE SUBROUTINE CKLOOP IS USED TO DETERMINE IF THE CONTOUR BEING
C   CALCULATED FOR ASDS OR DOSE IS "LOOPING."
C   THE FUNCTION SUBROUTINES VMAG AND VDOT ARE USED BY CKLOOP.
C   SUBROUTINE CKLOOP HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS:
C   CALL CKLOOP (RIP, M, NPTS, X, Y, DELS, TOL2, TOLLOP)
C   WHERE
C   RIP - A VARIABLE OF DIMENSION 2, THE FIRST TWO LOCATIONS OF WHICH
C   CONTAIN THE X- AND Y-COORDINATES, RESPECTIVELY, OF A CANDIDATE POINT
C   ON THE CONTOUR.
C   M - A RETURN VARIABLE INDICATING THE STATUS OF THE CANDIDATE POINT.
C   M=0, INDICATES POINT IS OK,
C   M=1, INDICATED POINT IS NOT OK.
C   NPTS - THE NUMBER OF THE CONTOUR POINTS THUS FAR GENERATED.
C   X - THE X-COORDINATE FOR THE CONTOUR POINTS.
C   DELS - THE MAXIMUM STEPSIZE BETWEEN POINTS.
C   TOL2 - THE CURRENT CONTOUR ERROR TOLERANCE.
C   TOLLOP - PROXIMITY TO CONTOUR FACTOR FOR LOOP CHECK COMPUTATION.
C   WILL ONLY BE USED IF VALUE IS LESS THAN TOL2.
C   THE CKLOOP SUBROUTINE IS CALLED ONLY FROM THE SUBROUTINE NWASDS AND
C   WILL ONLY BE CALLED IF ASDS OR DOSE CONTOURS ARE BEING COMPUTED.  IT
C   WILL BE CALLED MANY TIMES PER RUN.
C   THE INPUT TO CKLOOP IS PROVIDED ENTIRELY FROM THE CALLING ARGUMENTS.
```

```
C  THERE ARE THREE EXIT RETURNS FROM CKLOOP AT LINES NUMBERED 5, 21 AND
C  23 IN THE LISTING OF THE SUBROUTINE IN SECTION 5.  THE RETURN AT LINE
C  5 IS USED IF THE NUMBER OF POINTS GENERATED THUS FAR IS NOT
C  SUFFICIENT TO PERFORM THE LOOP CHECK.  THE RETURN AT LINE 21 IS
C  USED IF THE POINT IN QUESTION IS TOO CLOSE TO A SECTION OF THE
C  CONTOUR WHICH HAS ALREADY BEEN COMPUTED (I.E., A LOOPING CONDITION
C  EXISTS).
C  THE PROCESSING PERFORMED BY CKLOOP CONSISTS OF DETERMINING HOW CLOSE
C  A CANDIDATE CONTOUR POINT IS TO THE PORTION OF CONTOUR ALREADY
C  COMPUTED.  THE RESULT IS THEN COMPARED TO A CRITERION VALUE TO
C  DETERMINE IF THE PROGRAM COMPUTATIONS AND RESULTS ARE PROCEEDING IN
C  A LOGICAL MANNER.  IN ITS SEARCH FOR THE "NEXT POINT" ON A CONTOUR,
C  IT IS POSSIBLE THAT THE PROGRAM COULD FIND ONE IN A REGION FOR WHICH
C  THE CONTOUR HAS ALREADY BEEN CALCULATED, PARTICULARLY IN REGIONS
C  WHERE THE BOUNDARIES OF THE CONTOUR ARE CLOSE TOGETHER.  IF THIS
C  WERE ALLOWED TO HAPPEN, THE SUBSEQUENT POINTS ON THE CONTOUR WOULD
C  JUST RETRACE THE PATH ALREADY DESCRIBED BY PREVIOUS POINTS.  THIS
C  KIND OF BEHAVIOR, IF LEFT UNCHECKED, COULD CONTINUE INDEFINITELY.
C  THUS THE PURPOSE OF CKLOOP IS TO CATCH THE PROCESS IN TIME FOR
C  CORRECTIVE ACTION TO BE TAKEN.
```

SUBROUTINE CLOCK

This subroutine is System Dependent and must be supplied by the user. Subroutine CLOCK Resets/Initializes the run time clock variable. It is called from the Contour Analysis Main Program and is used in conjunction with subroutine CLOCKT to compute each contour's run time.

SUBROUTINE CLOCKT (T1)

This subroutine is System Dependent and must be supplied by the user. Subroutine CLOCKT interogates the system's run time clock and returns variable T1. Variable T1 contains the elapsed time since subroutine clock was called. These 2 routines provide a means of computing contour run time. Subroutine CLOCKT is also called from the contour Analysis Main Program.

Function CONTF

```
      FUNCTION CONTF (A)
C
C     ****************************************************************
C      A - RADIUS OF CURVATURE OF TURN
C      CONTF - CORRECTION TO NOISE LEVEL CAUSED BY TRACK GEOMETRY
C      PI - CONSTANT EQUALS THREE SOMETHING
C  CONTF - FUNCTION SUBROUTINE
C  CONTF IS USED TO COMPUTE CORRECTIONS TO NOISE LEVELS CAUSED BY TRACK
C  GEOMETRY
C  CONTF USES NO EXTERNAL SUBROUTINES.
C  CONTF HAS ONLY ONE ENTRY POINT AND THE CALLING SEQUENCE IS:
C  CONTF (A)
C  WHERE
C  A - TURN ANGLE, IN RADIANS, OF A CIRCULAR SEGMENT IN A TRACK
C  DEFINITION.
C  ONLY THE SUBROUTINE CURVE USES THE FUNCTION CONTF BUT MAY USE IT
C  MANY TIMES DURING EXECUTION.
C  THE INPUT DATA FOR CONTF IS THE CALL ARGUMENT.
C  CONTF HAS ONLY ONE EXIT RETURN.
C  THE VALUE COMPUTED BY CONTF IS RETURNED VIA THE FUNCTION NAME.
C  THE PROCESSING PERFORMED BY CONTF IS THE COMPUTATION OF THE MINIMUM
C  VALUE OF 3.0 OR 6A/II.
```

Function CONTG

```
      FUNCTION CONTG (DD,NT)
C
C     ****************************************************************
C      LOCAL VARIABLE DICTIONARY
C      CONTG - CORRECTION TO NOISE LEVEL CAUSED BY TRACK GEOMETRY
C     DD - DISTANCE TO SEGMENT
C      DMIN - (INPUT DATA TABLE) CONTAINS THE VALUE OF THE SHORTEST
C           STRAIGHT SEGMENT OR ONE HALF THE SHORTEST TURN RADIUS,
C                 WHICHEVER IS LEAST, FOR EACH TRACK (SIMILAR TO OLD
C                 NEW CAR WARRANTEES...)
C     NT - TRACK NUMBER
C      R - EFFECTIVE RADIUS
C  CONTG - FUNCTION SUBROUTINE
C  CONTG IS USED TO COMPUTE CORRECTIONS TO NOISE LEVELS CAUSED BY TRACK
C  GEOMETRY.
C  CONTG USES NO EXTERNAL SUBROUTINES.
C  THERE IS ONLY ONE ENTRY TO CONTG AND THE CALLING SEQUENCE IS:
C  CONTG (D, NT)
C  WHERE
C  D - IS THE DIFFERENCE IN THE DISTANCES FROM AN ANALYSIS POINT TO THE
C  CLOSEST TRACK SEGMENT AND TO THE NEXT-TO-CLOSEST SEGMENT ON THE SAME
C  TRACK.
C  NT - TRACK NUMBER.
C  ONLY SUBROUTINE NBT USES CONTG BUT MAY USE IT MANY TIMES.
C  THE INPUT DATA FOR CONTG IS FROM THE CALL ARGUMENTS AND THE TABLE
C  DMIN IN LABELED COMMON BLOCK/TRACK/.  THE TABLE DMIN CONTAINS THE
C  VALUE OF THE SHORTEST STRAIGHT SEGMENT OR ONE-HALF THE SHORTEST TURN
```

```
C  RADIUS, WHICHEVER IS LEAST, FOR EACH TRACK.
C  CONTG HAS ONLY ONE EXIT RETURN.
C  THE VALUE COMPUTED BY CONTG IS RETURNED VIA THE FUNCTION NAME.
C  THE VALUE COMPUTED BY CONTG IS (D/DMIN (HT))**2 AND FORMS A PART OF
C  A LARGER EQUATION BEING COMPUTED IN SUBROUTINE HBT.
```

Subroutine Curve

```
      SUBROUTINE CURVE (IGO1,IGO,R00,P,DD,TAU,DB,IE)
C
      ************************************************************************
C     LOCAL VARIABLE DICTIONARY
C     A - RADIUS OF CURVATURE )AS P)3((
C     ALPHA - ANGLE AT ORGIN BETWEEN TURN CENTER AND
C     POINT OF INTEREST
C     DB - NOISE LEVEL CORRECTION FOR POINTS INSIDE TURN
C     DD - DISTANCE TO SEGMENT OF INTEREST
C     IE - ERROR DISABLE FOR IGO
C     )ANGLE TRAVERSED GREATER THAN TURN ANGLE(
C     IGO - ERROR FLAG )SEE IF(
C     IGO1 - FLAG, TURN ANGLE GREATER THAN 180 DEGREES
C      P - VECTOR
C      PI ANGLE (CONSTANT RADIANS)
C     R00 - COORDINATES OF CURRENT POINT
C     S - DIFFERENCE VECTOR BETWEEN P AND R00
C     TAU - DISTANCE TRAVERSED ALONG TURN
C     TAUX - ANGLE AT TURN CENTER BETWEEN START OF CURVE AND
C     POINT OF INTEREST
C     THETA - NUMBER OF RADIANS IN TURN
C     X - SIGN OF A )NEGATIVE FOR RIGHT HAND TURNS(
C  CURVE - SUBROUTINE
C  THE SUBROUTINE CURVE IS USED TO COMPUTE THE SHORTEST DISTANCE FROM A
C  SPECIFIED POINT TO A SPECIFIED CIRCULAR SEGMENT ON A GIVEN TRACK AND
C  TO COMPUTE THE CORRECTION TO THE NOISE LEVEL FOR THE CONDITION WHERE
C  THE POINT IS ON THE INSIDE OF A TURN.
C  THE SUBROUTINE CURVE USES THE FOLLOWING SUBROUTINES DURING EXECUTION
C  SGN - SIGN OF A REAL NUMBER
C  VSUB - VECTOR SUBTRACTION
C  VMAG - VECTOR MAGNITUDE
C  CONTG - FUNCTION CALCULATION
C  CURVE HAS ONLY ONE ENTRY POINT AND IS CALLED BY ONLY ONE SUBROUTINE,
C  HBT, DURING EXECUTION BUT MAY BE CALLED MANY TIMES.  THE FOLLOWING
C  IS THE CALLING SEQUENCE FOR THE SUBROUTINE CURVE:
C  CALL CURVE (*,*, R0, P, D, TAU, DB, IE)
C  WHERE
C  * - MEMORY ADDRESS FOR RETURN TO CALLING PROGRAM IF THE POINT IS NOT
C  IN THE "RANGE" OF THE SEGMENT.
C  * - MEMORY ADDRESS FOR RETURN TO CALLING PROGRAM WHEN THE POINT IS
C  IN THE RANGE OF THE SEGMENT AND THE TURN ANGLE IS GREATER THAN 180.
C  R0 - VARIABLE OF DIMENSION 3, THE FIRST TWO POSITIONS OF WHICH
C  DEFINE THE X- AND Y-COORDINATES OF THE ANALYSIS POINT.
C  P - VARIABLE OF DIMENSION 5 OR MORE, THE FIRST FIVE POSITIONS OF
C  WHICH CORRESPOND TO THE FOLLOWING:
C  P(1) - X-COORDINATE OF THE CENTER OF THE CIRCULAR SEGMENT.
C  P(2) - Y-COORDINATE OF THE CENTER OF THE CIRCULAR SEGMENT.
C  P(3) - RADIUS OF CURVATURE OF THE SEGMENT.  A POSITIVE VALUE
C  INDICATES A LEFT TURN AND A NEGATIVE VALUE INDICATES A RIGHT TURN.
C  P(4) - THE TURN ANGLE IN RADIANS.
C  P(5) - THE ANGLE, IN RADIANS, BETWEEN A LINE JOINING THE CENTER WITH
```

```
C  THE START OF THE TURN AND THE POSITIVE X-AXIS.  ANGLE RANGES FROM-II
C  TO +II.
C  D - THE DISTANCE TO THE SEGMENT FROM THE POINT WHICH IS COMPUTED BY
C  CURVE AND RETURNED TO THE CALLING PROGRAM.
C  XM - THE DISTANCE, IN FEET, FROM THE BEGINNING OF THE TURN TO THE
C  POINT ON THE SEGMENT THAT MOST CLOSELY APPROACHES PO, COMPUTED BY
C  CURVE AND RETURNED TO THE CALLING PROGRAM.
C  PR - A NOISE CORRECTION VALUE COMPUTED BY CURVE WHEN PO IS ON THE
C  INSIDE OF A TURN.
C  IE - AN INDICATOR TO CURVE SENT BY THE CALLING PROGRAM.  A NONZERO
C  VALUE INDICATES THAT THE POINT IS THE SEGMENT RANGE.  OTHERWISE
C  CURVE MUST DETERMINE THIS ON ITS OWN.

C  ALL OF THE INPUT DATA FOR CURVE COMES FROM THE CALLING ARGUEMENTS
C  WITH THE EXCEPTION OF THE CONSTANT FOR II WHICH IS THE VARIABLE PI

C  IN LABELED COMMON BLOCK/CONST/.
C  THERE ARE THREE EXIT RETURNS FROM CURVE AT LINES NUMBERED 22, 37 AND
C  38 IN THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT LINE 22 IS
C  USED IF CURVE DETERMINES THAT THE POINT PO IS NOT IN THE SEGMENT
C  RANGE.  THE RETURN AT LINE 37 IS TAKEN IF THE POINT IS IN THE RANGE
C  AND THE TURN ANGLE IS GREATER THAN 180 (PI RADIANS).  THE RETURN AT
C  LINE 38 IS THE NORMAL RETURN IF THE TURN ANGLE IS LESS THAN OR EQUAL
C  TO 180 AND THE POINT IS IN THE RANGE OF THE SEGMENT.
C  DATA IS RETURNED TO THE CALLING PROGRAM THROUGH THE CALLING
C  ARGUMENTS ONLY, AS PREVIOUSLY DISCUSSED IN THE DESCRIPTION OF THE
C  CALLING ARGUMENTS.
C  THE PROCESSING PERFORMED BY CURVE CONSISTS, FIRST OF ALL, OF
C  COMPUTING THE MINIMUM DISTANCE FROM A POINT TO A CIRCULAR SEGMENT ON
C  A GROUND TRACK.
C  SECONDLY, CURVE MUST COMPUTE THE NOISE CORRECTION VALUE IF THE POINT
C  PO IS ON THE INSIDE OF THE TURN.  TO DETERMINE IF TO IS ON THE
C  INSIDE OF THE TURN, THE DISTANCE BETWEEN THE POINT AND THE CENTER OF
C  THE TURN IS COMPUTED AND THE RADIUS IS SUBTRACTED.  IF THE RESULT IS
C  NEGATIVE, PO IS ON THE INSIDE OF THE TURN, OTHERWISE IT IS NOT.
C  FINALLY, THE DISTANCE FROM THE BEGINNING OF THE TURN TO THE POINT OF
C  THE SEGMENTS CLOSEST APPROACH TO PO MUST BE COMPUTED.  THIS IS DONE
C  SIMPLY BY MULTIPLYING THE RADIUS OF THE SEGMENT TIMES THE ANGULAR
C  DISPLACEMENT OF THE POINT
```

Subroutine Date (DATER)

Subroutine Date is a System Dependent Routine and must be supplied by the user. This subroutine returns variable DATER which contains the current date. Subroutine Date is called Primarily by the contour and Grid Analysis Main Programs for generating Report Headers.

Function DELTA

```
      FUNCTION DELTA (A)
C
C     ******************************************************************
C
C      LOCAL VARIABLE DICTIONARY
C      A - PRESSURE ALTITUDE CORRECTION
C
C      DELTA - DELTA CORRECTION FOR UNCORRECTED THRUST VALUES
C      Z - EFFECTIVE ALTITUDE
C  DELTA - FUNCTION SUBROUTINE
C  DELTA COMPUTES THE DELTA (D) CORRECTION FOR UNCORRECTED THRUST
C  VALUES.
C  THE FUNCTION DELTA USES NO EXTERNAL SUBROUTINES.
C  DELTA HAS ONLY ONE ENTRY POINT AND THE CALLING SEQUENCE IS AS
C  FOLLOWS:
C  DELTA (A)
C  WHERE
C  A - A DISTANCE ABOVE THE GROUND AND NOT NECESSARILY THE DISTANCE
C  ABOVE MEAN SEA LEVEL.
C  THE FOLLOWING SUBROUTINES USE THE FUNCTION DELTA:
C  TABOP, PREPR, PROPDA
C  DELTA WILL BE USED MANY TIMES DURING EXECUTION.
C  THERE IS ONLY ONE EXIT RETURN FROM DELTA.
C  THE PROCESSING PERFORMED BY DELTA CONSISTS OF COMPUTING A FUNCTION
C  CORRESPONDING TO THE DELTA CORRECTION TO JET ENGINE NET THRUST,
C  SIMULATING THE EFFECT OF ALTITUDE PRESSURE DIFFERENTIALS.
C
C        NOISE IS ASSUMED TO BE A FUNCTION OF CORRECTED NET THRUST.
C        GIVEN: AIRPLANE HEIGHT(A IN FT), DELTA RETURNS A PRESS ALT CORR
C        FOR EFFICIENCY A SECOND ORDER BINOMIAL APPROXIMATION IS MADE
C             FOR THE EXPRESSION:
C
C                  DELTA=P/PO
C                       = C1. - (6.8756E-6)*A!**5.2559
C
```

Function DGTR

```
      FUNCTION DGTRD (DG)
C
C     ******************************************************************
C     CONST - CONVERSION FACTOR DEGREES TO RADIANS
C     DG - ANGLE IN DEGREES )IN CASE YOU DIDN_T GUESS(
C      DGTRD - ANGLE IN RADIANS
C  DGTRD - FUNCTION SUBROUTINE
C  DGTRD CONVERTS DEGREES TO RADIANS.
C  THE FUNCTION DGTRD DOES NOT USE ANY EXTERNAL SUBROUTINES.
C  DGTRD HAS ONE ENTRY POINT AND THE FOLLOWING IS THE CALLING SEQUENCE:
C  DGTRD (DG)
C  WHERE
C  DG - AN ANGLE IN DEGREES
C  THE SUBROUTINES TRAKRD, WINDRD AND NEWPNT USE THE FUNCTION DGTRD.
C  THE INPUT TO DGTRD IS THROUGH THE CALLING ARGUMENT.
C  DGTRD HAS ONLY ONE EXIT RETURN.
C  THE ANGLE VALUE IN RADIANS IS RETURNED VIA THE SUBROUTINE NAME.
C  THE PROCESSING PERFORMED BY DGTRD CONSISTS OF THE FOLLOWING FORMULA:
C  DGTRD=A(0.017453)
C
```

Function EGA

```
      FUNCTION EGA (VD,Q3,IGO)
C
C     ****************************************************************
C      LOCAL VARIABLE DICTIONARY
C     BETA - SINE OF ELEVATION ANGLE OF VD
C      EGA - GROUND ATTENUATION
C     FBETA - WEIGHTING FACTOR,REGULAR TO EXCESS ATTENUATION
C
C     GR - DISTANCE ALONG GROUND USED TO CALCULATE EGA
C      I - ARRAY ELEMENT ARG
C     IGO - ERROR FLAG
C     LGR - LOG OF R
C     Q3 - ELEVATION OF VD
C     R - LENGTH OF VD
C     VD - DIFFERENCE VECTOR (EXTERNALLY DETERMINED)
C     X - COORDINATE OF TEST STEPS ALONG GROUND TRACK
C      XX - ATTENUATION AND DISTANCE  DATA (FUNCTION OF TAN BETA)
C     Y - COORDS OF TEST STEPS ALONG GROUND TRACK
C      YY - ATTENUATION AND DISTANCE  DATA (FUNCTION OF COS BETA)
C  EGA - FUNCTION SUBROUTINE
C  EGA COMPUTES THE EXCESS GROUND ATTENUATION FOR THE COMPUTATION OF LA
C  USED IN ASDS AND DOSE COMPUTATIONS.  THE FUNCTION EGA DOES NOT USE
C  EXTERNAL SUBROUTINES.  EGA HAS ONE ENTRY POINT AND THE CALLING
C  SEQUENCE IS:
C  EGA (VD,Q3,*)
C  VD - A DIMENSION 3 OR MORE VARIABLE, THE FIRST THREE POSITIONS OF
C  WHICH DEFINE THE X-, Y- AND Z-COORDINATES OF A VECTOR POINTING FROM
C  THE AIRCRAFT TO THE ANALYSIS POINT.
C  Q3 - THE HEIGHT ABOVE THE GROUND OF THE ANALYSIS POINT.
C  * - MEMORY LOCATION FOR ERROR RETURN IF ANALYSIS POINT IS ABOVE THE
C  AIRCRAFT (I.E., VD(3)>0).
C  THE SUBROUTINE TIHISI IS THE ONLY USER OF THE FUNCTION EGA.  IT WILL
C  BE USED MANY TIMES PER RUN IF ASDS OR DOSE VALUES ARE CALCULATED.
C  OTHERWISE, IT WILL NOT BE USED AT ALL.
C  INPUT DATA RELATING ANALYSIS POINT AND AIRCRAFT POSITIONAL DATA ARE
C  PROVIDED BY THE CALLING ARGUMENTS.  OTHERWISE, THE ATTENUATION AND
C  DISTANCE DATA ARE CONTAINED WITHIN EGA.
C  EGA HAS FOUR EXIT RETURNS LOCATED AT LINES NUMBERED 13, 14, 18 AND
C  22 OF THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT LINE 13 IS
C  USED IF THE ANALYSIS POINT IS ABOVE GROUND LEVEL (I.E., Q3>0).  THE
C  RETURN AT LINE 14 IS AN ERROR RETURN AND IS USED IF THE AIRCRAFT IS
C  BELOW THE ANALYSIS POINT (I.E.,VD(3)>0).  THE RETURN AT LINE 18 IS
C  USED IF THE ELEVATION ANGLE IS GREATER THEN 10.  THE RETURN AFTER
C  THE EXCESS GROUND ATTENUATION HAS BEEN COMPUTED.
C  THE GROUND ATTENUATION COMPUTED BY EGA IS RETURNED THROUGH THE
C  FUNCTION NAME.  ERROR INFORMATION IS TRANSMITTED BY THE RETURN AT
C  LINE 14.
C  THE PROCESSING PERFORMED BY EGA IS THE COMPUTATION OF EXCESS GROUND
C  ATTENUATION FOR ANALYSIS POINT TO AIRCRAFT ELEVATION ANGLES UP TO 10
C
```

Subroutine EQUOPS

```
      SUBROUTINE EQUOPS(OPS,EQOPS,W3,WW)
C
C     * * * * * * * * * * * * * * * * * * *
C
C           WP = EVENING WEIGHTING FACTOR
C
C           WW = NIGHT WEIGHTING FACTOR
```

Subroutine EXIT

This subroutine is available in most FORTRAN compilers. If not, the user must supply this routine. Subroutine EXIT returns control to the operating system and, therefore, terminates the execution of the program.

Function EXPOSE

```
      FUNCTION EXPOSE (*,*TST2)
C
C     ***************************************************************
C      LOCAL VARIABLE DICTIONARY
C     AG - GROUND ATTENUATION, SECONDARY
C       ASCAMS - ASSOCIATE TABLE
C      ASDMN/ASDMN - CLOSEST DISTANCE TO THRESHOLD EXAMINED
C                                 BY ASDS II/III  PCA ANALYSIS.
C      ASDMX/ASDMX - FARTHEST DISTANCE TO THRESHOLD EXAMINED
C                                 BY ASDS II/III PCA ANALYSIS.
C       ASTABS - ASSOCIATE TABLE
C       ASDMN - SIMILAR TO ASDMN FOR ASDS2.
C       ASDMX - SIMILAR TO ASDMX FOR ASDS2.
C       AVALS - TABLE OF NOISE EXPOSURE VALUES AT A POINT
C      AXP - CUMULATIVE VALUE FOR PRIMARY METRIC.
C      AXS2 - CUMULATIVE VALUES FOR SNDARY METRIC.
C     DA, DB - NOISE LEVEL CORRECTIONS
C       DA - NOISE VALUE CORRECTION FOR CLOSEST SEGMENT
C       DAT - DISTANCE ALONG THE TRACK FROM THRESHOLD TO THE
C                        TRACKAS POINT OF CLOSEST APPROACH. (RETURNED)
C     DATRK - DISTANCE ALONG PRIMARY SEGMENT
C       DCUM - TABLE OF DISTANCE CRITERIA
C       DS - DISTANCE TO SECONDARY TRACK FROM RO
C     DST - DISTANCE ALONG PRIMARY SEGMENT FROM END OF RUNWAY TO
C     CLOSEST APPROACH
C     DT - DISTANCE TO SECONDARY SEGMENT
C      DTA - DISTANCE FROM POSITION TO TRACK AT THE TRACKAS
C                        POINT OF CLOSEST APPROACH. (RETURNED)
C     DTR - DISTANCE FROM SECOND CLOSEST SEG OR TRK TO ORG
C     G - GROUND ATTENUATION, PRIMARY
```

```
C      AT - ALTITUDE(RETURNED)
C      IPAC - INDEX FOR NOISE CURVE SET (1 TO 20)
C       ITPRAC - TABLE OF ENCODED A/C TABLE ARRAY ARGUMENTS
C      ITR - TABLE OF RUNWAY ASSIGNMENTS FOR EACH TRACK
C       ITT - DUMMY ARGUMENT FOR SIFT
C       J - LOOP COUNTER
C       JUNC - CONSTANT, '2)
C       KK - LOOP COUNTER
C       MASK - DECODES INFORMATION FROM ITPRAC
C      MAXS - NO. OF CLOSEST SEGMENT (RETURNED)
C      MAXS - PCA SEGMENT NUMBER (SENT)
C      MAXT - NO. OF SECONDARY SEGMENT (RETURNED)
C                        RETURNED ONLY IF A SECOND SEGMENT ON THE
C                        TRACK APPROACHES CLOSE ENOUGH TO COUNT. (RETUR
C     MPRF - PROFILE NUMBER )SECONDARY(
C       NAMS - TABLE OF CLOUMN HEADINGS
C       NCALC - LOGICAL FLAG, CALCULATE JUST PRI ARY OR ALL METRICS
C       ND - NUMBER OF TABLE ENTRIES TO CLEAR IN ANOIS
C       NEWT - FLAG, CLEAR ANSWER TABLE IF SET '1
C       NEFT - TOTAL NUMBER OF DEFINED FLIGHTS
C         NGT - DUMMY VAR, PREVIOUS TRACK GROUP NUMBER
C       NOBS - NUMBER OF OBSERVERS )MEASUREMENT LOCATIONS(
C       NONSTD - LOGICAL FLAG, INDICATES NONSTANDARD TAKEOFF PROFILES
C       NOPS - NUMBER OF OPERATIONS FOR A GIVEN TRACK AND TIME PERIOD
C       NP1234 - FLAG, INDICATES PRIMARY METRIC IS NOT A T/A METRIC
C       NPNUMS - LOGICAL FLAG, T/A METRIC MUST BE CALCUALTED
C      NPPF - PROFILE NUMBER (PRIMARY) (1 TO 150)
C     NT - TRACK NUMBER )SECONDARY(
C                  NT = TRACK NUMBER  (SENT)
C      NTRK - TRACK NUMBER (STORED IN ASDS COMMON BLOCK)
C      NTG - TRACK GROUP NUMBER (1 TO 25)
C       NTST - DUMMY VAR, PREVIOUS VALUE OF NTST1
C                  NTST = 2 MEANS CLOSEST SEGMENT IS KNOWN    (SENT)
C
C                       NOT= 2 MEANS CLOSEST SEGMENT UNKNOWN
C
C       NTST1 - USE ALL FLIGHTS IN COMPUTATIONS THIS PASS
C       NTST2 - HAS EXPOSURE BEEN DETERMINED FOR BOTH
C             FORWARD AND BACKWARD TIME HISTORIES
C     NTG - TRACK GROUP NUMBER
C     NTRK - TRACK NUMBER )PRIMARY(
C       NTM - LOGICAL FLAG ARRAY, INDICATES WHETHER EACH METRIC )1-6(
C                IS TO BE CALCULATED
C       NUMSCRS - INDICATES T/A METIRCS ARE TO BE CALCULATED
C       NUMALT - ALTERNATE METRIC NUMBER
C       NUMNUM - DUMMY VAR, NUMPR
C       NUMPR - PROFILE NUMBER
C       NYS - NUMBER OF TIMES THROUGH EXPOSE FOR A GIVEN POINT
C                  )EXTERNALLY RESET(
C       PRFCT - WIEGHTING FACTORS, PRIMARY METRIC
C       PROF - PROFILE TABLE
C      P00 - POSITION X-Y COORDINATE (SENT)
C      RL - TABLE OF RUNWAY LENGTHS FOR EACH RUNWAY
C     RWL - RUNWAY LENGTH
C                        SET TO ZERO EXCEPT FOR LANDINGS WHERE R0
C                        IS BEYOND THE STOPPING POINT OF THE AIRCRAFT.
C     SLR - SLANT RANGE   (DISTANCE FROM R00 TO THE AIRCRAFT)
C       ST - DISTANCE ALONG TRACK
C         TABLE - TABLE OF DEFINED FLIGHTS
C      TH - THRUST (RETURNED)
```

```
C       V - GROUND SPEED (RETURNED)
C       VV - A/C VELOCITY, EXTERNALLY DETERMINED
C       VO - COORDINATE POSITION
C     WFCTRS - ENERGY METIC WEIGHTING FACTORS
C     XLV - VALUE FOR PRIMARY METRIC AT POINT OF CLOSEST APPROACH
C      XLV2 - VALUES FOR 2NDARY METRICS AT PCA.
C      YLV - VALUE FOR PRIMARY METRIC AT SECONDARY APPROACH
C      YLV2 - VLAUES FOR 2NDARY METRICS AT 2NDARY APPR.
C     ZLV - TOTAL VALUE FOR PRIMARY METRIC FOR THIS FLIGHT
C      ZLV2 - TOTAL VALUES FOR 2NDARY METRICS FOR THIS FLIGHT
C  EXPOSE - FUNCTION SUBROUTINE
C  EXPOSE IS THE EXECUTIVE SUBROUTINE ASSIGNED TO COMPUTE THE NOISE
C  EXPOSURE AT A GIVEN POINT AS A RESULT OF ALL DEFINED AIRCRAFT
C  OPERATIONS.  EXPOSE TALLIES CUMULATIVE SUMS OF INDIVIDUAL
C  CONTRIBUTIONS TO FINALLY ARRIVE AT A TOTAL.  THE PRIMARY INTERNAL
C  FUNCTION OF EXPOSE IS TO DECIDE WHICH QUANTITIES NEED TO BE COMPUTED
C  AND THEN ACCESS THE PROPER SUBROUTINES WHICH PERFORM THE ACTUAL
C  COMPUTATIONS.
C  THE FUNCTION EXPOSE USES THE SUBROUTINES ACNOIS, A3DS2, A3DS3,
C  ATTENG, HBT, PREPP, SIFT, AND ZERO.
C  EXPOSE HAS ONLY ONE ENTRY AND THE CALLING SEQUENCE IS:
C  EXPOSE (RO, NTST)
C  WHERE
C  RO - A VARIABLE OF DIMENSION 3 OR MORE, THE FIRST TWO POSITIONS OF
C  WHICH DEFINE THE X- AND Y-COORDINATES OF THE ANALYSIS POINT.
C  NTST - INDICATES WHETHER TO USE ALL FLIGHTS OR ONLY "SIGNIFICANT"
C  FLIGHTS IN THE COMPUTATION OF THE NOISE LEVEL AT THE ANALYSIS POINT.
C  THE SUBROUTINES THAT USE EXPOSE ARE FIRST, GRADIE, NEWPNT AND NWASDS
C  IN ADDITION TO THE MAIN PROGRAM NOISE1.  EXPOSE WILL NORMALLY BE
C  CALLED MANY TIMES DURING EXECUTION.
C  THE INPUT DATA FOR EXPOSE COMES FROM ITS OWN CALL ARGUMENTS AS WELL
C  AS SOME OF THE CALL ARGUMENTS OF THE SUBROUTINES IT USES.  OTHER
C  DATA IS PASSED VIA LABELED COMMON BLOCKS.
C  EXPOSE HAS FOUR EXIT RETURNS LOCATED AT LINES NUMBERED 519, 522, 524
C  AND 530 IN THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT LINE
C  519 IS THE NORMAL RETURN USED WHEN THE COMPUTATION OF THE NOISE
C  VALUE AT A POINT IS COMPLETE.  THE RETURN AT LINE 522 IS USED WHEN
C  THE COMPUTED NOISE VALUE FOR A FLIGHT IS EXCESSIVELY LARGE, USUALLY
C  WHEN THE AIRCRAFT IS EXTREMELY CLOSE TO THE ANALYSIS POINT, AND NO
C  DIAGNOSTIC PRINTOUT IS REQUESTED.  THE RETURNS AT LINES 524 AND 530
C  ARE TAKEN UNDER THE SAME CIRCUMSTANCES WHEN A DIAGNOSTIC PRINTOUT IS
C  PROVIDED.
C  THE TOTAL NOISE EXPOSURE AT A POINT, FOR THE PRIMARY METRIC, IS
C  RETURNED THROUGH THE FUNCTION NAME.  OTHERS, IF ANY, ARE RETURNED IN
C  TABLE AVALS IN LABELED COMMON BLOCK/METRIC/.
C  THE PROCESSING PERFORMED BY EXPOSE CONSISTS OF COMPUTING THE NOISE
C  EXPOSURE AT A POINT FOR ALL OR SELECTED DEFINED AIRCRAFT FLIGHTS.
```

Function EXPOSG

```
      SUBROUTINE EXPOSG (P00,IER,NCTA)                          03-02-79
C
C     ******************************************************************
C      LOCAL VARIABLE DICTIONARY
C     AT - GROUND ATTENUATION, SECONDARY
```

```
C      ALT - AIRCRAFT ALTITUDE ABOVE RUNWAY LEVEL
C       ASDANS - ANSWER TABLE
C      ASDMN/ASDMN - CLOSEST DISTANCE TO THRESHOLD EXAMINED
C                                  BY ASDS II/III  PCA ANALYSIS.
C       ASDMX/ASDMX - FARTHEST DISTANCE TO THRESHOLD EXAMINED
C                                  BY ASDS II/III PCA ANALYSIS.
C       ASDANS - ANSWER TABLE
C       ASDMN - SIMILAR TO ASDMN FOR ASDS2.
C       ASDMX - SIMILAR TO ASDMX FOR ASDS3.
C      ASDSOI - ASDS EXPOSURE FOR CURRENT FLIGHT (COMMON VIA ACNOIS, ETC)
C      ASDSOR - RUNNING TOTAL OF EXPOSURE FOR PRIMARY METRIC (ASDS)
C       AVALS - TABLE OF NOISE EXPOSURE VALUES AT A POINT
C      AVALSO - AS AVALS, SECONDARIES
C      AXE - CUMULATIVE VALUE FOR PRIMARY METRIC.
C      AXE2 - CUMULATIVE VALUES FOR 2NDARY METRIC.
C     DA, DB - NOISE LEVEL CORRECTIONS
C       DA - NOISE VALUE CORRECTION FOR CLOSEST SEGMENT
C       DAT - DISTANCE ALONG THE TRACK FROM THRESHOLD TO THE
C                          TRACK'S POINT OF CLOSEST APPROACH. (RETURNED)
C       DS - DISTANCE TO SECONDARY TRACK FROM RO
C     DST - DISTANCE ALONG PRIMARY SEGMENT FROM END OF RUNWAY TO
C     CLOSEST APPROACH
C     DT - DISTANCE TO SECONDARY SEGMENT
C      DTA - DISTANCE FROM POSITION TO TRACK AT THE TRACK'S
C                          POINT OF CLOSEST APPROACH. (RETURNED)
C     DTR - DISTANCE FROM SECOND CLOSEST SEG ON TRK TO ORG
C     GA - GROUND ATTENUATION, PRIMARY
C      HT - ALTITUDE(RETURNED)
C      IAPP - APPROACH PARAMETER I.D. (ORDINAL)                          03-28-79
C      IER - OPTIONAL OUTPUT INDICATOR - NONZERO MEANS DETAILED FLIGHT DATA
C      ITRAC - INDEX FOR NOISE CURVE SET (1 TO 20)
C       ITPPAC - TABLE OF ENCODED A/C TABLE ARRAY ARGUMENTS
C      ITR - TABLE OF RUNWAY ASSIGNMENTS FOR EACH TRACK
C       ITT - DUMMY ARGUMENT FOR SIFT
C       KK - LOOP COUNTER
C       MASK - DECODES INFORMATION FROM ITPPAC
C      MAXS - NO. OF CLOSEST SEGMENT (RETURNED)
C      MAXS - PCA SEGMENT NUMBER (SENT)
C      MAXT - NO. OF SECONDARY SEGMENT (RETURNED)
C                          RETURNED ONLY IF A SECOND SEGMENT ON THE
C                          TRACK APPROACHES CLOSE ENOUGH TO COUNT. (RETUR
C     MPRF - PROFILE NUMBER )SECONDARY(
C       NFLT - TOTAL NUMBER OF DEFINED FLIGHTS
C       NOBS - NUMBER OF OBSERVERS )MEASUREMENT LOCATIONS(
C       NOPS - NUMBER OF OPERATIONS FOR A GIVEN TRACK AND TIME PERIOD
C      NOTA - 1 IF NO TIME ABOVE IS TO BE CALCULATED                     03-28-79
C      NPRF - PROFILE NUMBER (PRIMARY) (1 TO 150)
C     NT - TRACK NUMBER )SECONDARY(
C                  NT = TRACK NUMBER  (SENT)
C      NTG - TRACK GROUP NUMBER (1 TO 25)
C      NTRK - TRACK NUMBER (STORED IN ASDS COMMON BLOCK)
C       NTST - DUMMY VAR, PREVIOUS VALUE OF NTST1
C                  NTST = 2 MEANS CLOSEST SEGMENT IS KNOWN   (SENT)
C                       NOT= 2 MEANS CLOSEST SEGMENT UNKNOWN
C       NTST1 - USE ALL FLIGHTS IN COMPUTATIONS THIS PASS
C       NTST2 - HAS EXPOSURE BEEN DETERMINED FOR BOTH
```

```
C              FORWARD AND BACKWARD TIME HISTORIES

C       NUMALT - ALTERNATE METRIC NUMBER

C       NUMPR - PROFILE NUMBER

C      OTHERS - RUNNING TOTAL OF ALTERNATE METIRC EXPOSURES
C      POINT - CURRENT POINT
C       PREFCT - WIEGHTING FACTORS, PRIMARY METRIC
C       PROF - PROFILE TABLE
C      PWRS - A/C THRUST SETTINGS (COMMON)
C      R00 - POSITION X-Y COORDINATE (SENT)
C      RI - TABLE OF RUNWAY LENGTHS FOR EACH RUNWAY
C     RWL - RUNWAY LENGTH
C                          SET TO ZERO EXCEPT FOR LANDINGS WHERE R0
C                          IS BEYOND THE STOPPING POINT OF THE AIRCRAFT.
C     SLR - SLANT RANGE    (DISTANCE FROM R00 TO THE AIRCRAFT)
C      TH - THRUST (RETURNED)
C      V - GROUND SPEED (RETURNED)
C       VO - COORDINATE POSITION
C       VV - A/C VELOCITY, EXTERNALLY DETERMINED
C     WFCTRS - ENERGY METRIC WEIGHTING FACTORS
C     XYV - VALUE FOR PRIMARY METRIC AT POINT OF CLOSEST APPROACH
C      XYV2 - VALUES FOR 2NDARY METRICS AT PCA.
C      YTV - VALUE FOR PRIMARY METRIC AT SECONDARY APPROACH
C      YTV2 - VLAUES FOR 2NDARY METRICS AT 2NDARY APPR.
C     ZYV - TOTAL VALUE FOR PRIMARY METRIC FOR THIS FLIGHT
C      ZYV2 - TOTAL VALUES FOR 2NDARY METRICS FOR THIS FLIGHT
C  EXPOSG - SUBROUTINE
C  THE SUBROUTINE EXPOSG CONTROLS THE COMPUTATIONS OF THE NOISE
C  EXPOSURE VALUES AT A GIVEN POINT.  EXPOSG PLAYS THE SAME ROLE FOR
C  THE GRID ANALYSIS MODEL AS THE FUNCTION EXPOSE DOES FOR THE CONTOUR
C  ANALYSIS MODEL.
C  EXPOSG CALLS THE SUBROUTINES VTRN, ZERO, HBT, PREPR, ATTENG AND
C  ACNOTS WHICH ARE ALL DESCRIBED IN SECTION 2.  ASDS2G AND ASDS3G ARE
C  ALSO CALLED AND THEY ARE DESCRIBED EARLIER IN THIS SECTION.
C  EXPOSG HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS:
C  CALL EXPOSG (A,IER)
C  WHERE
C  A  A VARIABLE OF DIMENSION OR MORE WHICH CONTAINS THE XY-
C  COORDINATES OF THE ANALYSIS POINT IN THE FIRST TWO POSITIONS.
C  IER  OPTIONAL OUTPUT INDICATOR.
C  IF IER=0, NO OUTPUT
C  IF IER=0, OUTPUT DETAILED FLIGHT DATA.
C  EXPOSG IS CALLED BY THE MAIN PROGRAM GRIDPR AND WILL BE CALLED ONCE
C  PER GRID POINT TO BE PROCESSED.
C  THE INPUT TO EXPOSG IS THROUGH THE CALLING ARGUMENTS FROM THE
C  CALLING PROGRAM AS WELL AS THE CALLING ARGUMENTS TO THE SUBROUTINES
C  THAT EXPOSG CALLS.  OTHER INPUT IS PASSED THROUGH LABELED COMMON
C  BLOCKS.
C  THERE ARE TWO EXIT RETURNS FROM EXPOSG, LOCATED AT LINES NUMBERED 80
C  AND 83 IN THE SUBROUTINE LISTING IN SECTION 3.  THE RETURN AT LINE
C  80 IS A NORMAL RETURN.  THE RETURN AT LINE 83 IS AN ERROR RETURN
C  AND IS USED WHEN THE DISTANCE BETWEEN THE ANALYSIS POINT AND AN
C  AIRCRAFT IS VERY SMALL.
C  THE OUTPUT FROM EXPOSG CONSISTS OF THE VALUES FOR THE VARIABLES IN
C  LABELED COMMON BLOCK/GPOUT/ WHICH WERE DESCRIBED IN SECTION 3.2 AND
C  THE OPTIONAL OUTPUT, IF ANY.
C
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Subroutine FIRST

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      SUBROUTINE FIRST (P0),VEV1)
C
C     ********************************************************************
C     LOCAL VARIABLE DICTIONARY
C     COR - FACTOR TO ADJUST STARTING POINT IF FIRST GUESS YEILDS
C     TOO GREAT AN EXPOSURE, EITHER 1/2 OR 1/8
C     DERIV - MAGNITUDE OF THE GRADIENT AT POINT
C     GRAD - UNIT GRADIENT VECTOR (POINTS TOWARDS GREATEST EXPOSURE CHANGE)
C     H - APPROXIMATE DISTANCE NECESSARY TO MOVE POINT FOR NEXT GUESS
C     ERROR - ERROR FLAG, DUMMY
C     IRBIG - NUMBER OF BUSIEST TAKEOFF RUNWAY
C     VEV11 - NOISE EXPOSURE AT FIRST POINT ON CONTOUR
C     NOBS - NUMBER OF OBSERVERS
C     NUMPO - PRIMARY "STRIP NUMBER
C     NYS - COUNTS NUMBER OF TIMES THROUGH EXPOSE (BURN THAT TIME)
C     P - HOLDS P00 WHILE ITS VALUE IS CHANGED, ETC
C     PA - PA IS THE INPUT START POINT
C     RCON - RCON ANOTHER FACTOR TO ADJUXT POINT SEARCH , 2
C     RCON - RCON ANOTHER FACTOR TO ADJTXT POINT SEARCH , 3/2, SEE LINE 87
C     RL - RUNWAY LENGTHS, TABLE
C     RLBI - RUNWAY LENGTH OF BUSIEST RUNWAY TIMES MAGIC FACTOR RCON   3/2
C     RP - RESTRAINT OF P00 VIEWS *
C     RTOL - CONTOUR ERROR TOLERANCE
C     V1 - EXPOSURE AT P00
C     V2 - DIFFERENCE OF V1 AND CONTOUR VALUE
C     VAL - CONTOUR VALUE
C     VALMAX - VAL PLUS TOL, ALLOWABLE MAX VALUE ON CONTOUR
C     VALMIN- CONTOUR VALUE MINUS ERROR TOLERANCE
C     XA - RUNWAY START X,Y COORDS
C     XB - RUNWAY END X,Y COORDS
C     XBD - X END COORD OF BUSIEST RUNWAY
C     XST - X START COORD OF BUSIEST TAKEOFF RUNWAY
C     YBD - Y END COORD OF BUSIEST TAKEOFF RUNWAY
C     YST - Y START COORD OF BUSIEST TAKEOFF RUNWAY
C   FIRST - SUBROUTINE
C  THE PURPOSE OF SUBROUTINE FIRST IS TO FIND THE FIRST POINT ON A
C  CONTOUR.  IT WILL USE EITHER THE GRADIENT METHOD OR THE RUNWAY
C  PERTURBATION METHOD TO FIND THE FIRST POINT.
C  THE SUBROUTINE FIRST USES THE SUBROUTINES EXPOSE, GRADIE, VMAG, VSUB
C  PTEX, AND VBMT.
C  THE SUBROUTINE FIRST HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS
C  CALL FIRST (P0, VEV1)
C  WHERE
C  P0 - A VARIABLE OF DIMENSION 2 OR MORE, THE FIRST TWO POSITIONS OF
C  WHICH INDICATE THE METHOD TO BE USED BY FIRST TO FIND THE FIRST
C  POINT.  IF BOTH VALUES ARE ZERO, THE BUSIEST TAKEOFF RUNWAY METHOD
C  WILL BE USED.  IF EITHER OR BOTH POSITIONS ARE NONZERO, THE FIRST IS
C  ASSUMED TO BE THE X-COORDINATE AND THE SECOND THE Y-COORDINATE OF
C  THE USERS ESTIMATE AS WHERE THE FIRST POINT IS AND STARTING THERE,
C  THE ITERATIVE GRADIENT METHOD WILL BE USED TO FIND THE FIRST POINT.
C  VEV1 - THE NOISE EXPOSURE VALUE AT THE FIRST POINT ON THE CONTOUR.
C  ONLY THE MAIN PROGRAM NOISE1 USES THE SUBROUTINE FIRST.
C  THE SUBROUTINE FIRST WILL BE USED ONLY ONCE PER CONTIGUOUS CONTOUR.
C  NOTE THAT ONE "CONTOUR" MAY BE COMPOSED OF SEVERAL DISJOINT CONTOURS
C  HAVING THE SAME METRIC VALUE.
C  THE DATA INPUT TO FIRST IS THE CALLING ARGUMENT P0, PREVIOUSLY
C  DESCRIBED, AND THROUGH LABELED COMMON BLOCKS.  THE FOLLOWING WILL
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C  DETAIL THE COMMON BLOCK INPUT.
C  /BK/       TOL      CONTOUR ERROR TOLERANCE
C             VAL      CONTOUR VALUE
C  /RUNWAY/   XA       RUNWAY START XY-COORDINATES
C             YB       RUNWAY END XY-COORDINATES
C  /RNYNO/    IRNIG    NUMBER OF DISTANT TAKEOFF RUNWAY

C  /METRIC/   NMETR    NUMBER OF PRIMARY METRIC

C                       1=NEF

C                       2=CNR
C                       3=CNP
C                       4=LEQ
C                       5=ASDS
C                       6=DNSR
C  FIRST HAS TWO EXIT RETURNS LOCATED AT LINES NUMBERED 52 AND 139 OF
C  THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT LINE 52 IS THE
C  RETURN AFTER USING THE GRADIENT METHOD TO FIND THE FIRST POINT.  THE
C  RETURN AT LINE 139 IS USED AFTER THE RUNWAY METHOD WAS TO FIND THE
C  FIRST POINT.  THE OUTPUT OF FIRST IS RETURNED TO THE CALLING
C  PROGRAM THROUGH THE CALLING ARGUMENTS.  THE XY-COORDINATES OF THE
C  POINT ON THE CONTOUR ARE CONTAINED IN THE VARIABLE RO, AND THE NOISE
C  VALUE AT THAT POINT IS CONTAINED IN THE VARIABLE EEY1.  DEPENDING ON
C  THE INPUT DATA, THE SUBROUTINE FIRST WILL EXERCISE ONE OF THE TWO
C  DIFFERENT METHODS TO FIND THE FIRST POINT ON A GIVEN NOISE EXPOSURE
C  CONTOUR.  THE USER REQUEST THAT THE PROGRAM FIND THE FIRST POINT ON
C  ITS OWN, OR CAN REQUEST THE PROGRAM TO BEGIN THE SEARCH AT A
C  SPECIFIC POINT.  THE USER CHOOSES THE METHOD TO BE USED BY SELECTING
C  THE VALUE OF THE ESTIMATED POSITION OF THE FIRST POINT ON THE
C  CONTOUR.  IF THE ESTIMATE IDENTICALLY X=Y=0, THE PROGRAM WILL FIND
C  THE FIRST POINT ON ITS OWN USING THE GRUNWAY METHOD.  OTHERWISE,
C  THE GRADIENT METHOD WILL BE USED.  THE FOLLOWING PARAGRAPHS DESCRIB
C  EACH OF THESE METHODS.
C  IF THE USER CHOOSES TO DIRECT THE PROGRAM TO A SPECIFIC AREA TO
C  SEARCH FOR THE CONTOUR, AN XY-COORDINATE POINT MUST BE SPECIFIED.
C  THE NOISE EXPOSURE IS COMPUTED AT THIS POINT BY THE PROGRAM TO
C  DETERMINE IF IT IS ON THE CONTOUR.  IF SO, THE SEARCH IS OVER.  IF
C  NOT, THE VECTOR WHICH DEFINES AN APPROXIMATE LOCAL NOISE CONTOUR
C  GRADIENT IS DETERMINED BY COMPUTING THE NOISE EXPOSURE AT TWO MORE
C  POINTS: ONE AT A FEET IN THE POSITIVE-X DIRECTION, AND THE OTHER AT
C  A FEET IN THE POSITIVE-Y DIRECTION RELATIVE TO THE ORIGINAL POINT.
C  THE VECTOR RESULTING FROM THE DIFFERENCES BETWEEN THE ORIGINAL
C  POINT AND THE TWO OTHERS WILL POINT IN THE DIRECTION OF INCREASING
C  NOISE EXPOSURE FOR THE LOCAL AREA.  THE DIRECTION OF THE GRADIENT
C  VECTOR DETERMINES THE DIRECTION THE PROGRAM WILL PROCEED FOR THE
C  NEXT TRIAL POINT.  IF THE NOISE EXPOSURE AT THE ORIGINAL POINT WAS
C  SMALLER THAN THE SPECIFIED CONTOUR VALUE, THE PROGRAM WILL PROCEED
C  IN THE SAME DIRECTION AS THE GRADIENT VECTOR.  IF THE VALUE WAS
C  LARGER, THE PROGRAM WILL PROCEED IN A DIRECTION OPPOSITE THE
C  GRADIENT VECTOR.  THIS PROCEDURE IS REPEATED UNTIL A POINT ON THE
C  CONTOUR IS FOUND.
C  IF THE USER CHOOSES THE OPTION OF HAVING THE PROGRAM FIND THE FIRST
C  POINT ON ITS OWN, THE MODEL WILL CHOOSE THE MOST HEAVILY-USED
C  TAKEOFF RUNWAY AND COMPUTE NOISE VALUES ON A LINE COINCIDENT WITH
C  THE RUNWAY CENTERLINE UNTIL THE CONTOUR VALUE IS FOUND OR IS
C  BRACKETED BY TWO SUCCESSIVE NOISE EXPOSURE LEVEL COMPUTATIONS.  IF
C  BRACKETED, NOISE VALUES ARE THEN COMPUTED BETWEEN THE TWO POINTS,
C  USING INTERPOLATION, UNTIL A VALUE WITHIN A PRESPECIFIED TOLERANCE
C  OF THE CONTOUR IS FOUND.  FOR THE INITIAL NOISE LEVEL COMPUTATIONS
C  ALONG THE EXTENDED RUNWAY CENTERLINE, THE DISTANCE BETWEEN
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C  SUCCESSIVE POINTS MAY BE HALF THE LENGHT OF THE SUBJECT RUNWAY AS
C  DEFINED IN THE PROGRAM.
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Function GENFN1

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      FUNCTION GENFN1 (Y,X,XX,N,I)
C     ****************************************************************************

C
C       GENFN1 PERFORMS A LINEAR INTERPOLATION ON A TABLE Y
C     GENFN1 - THE CALCULATED VALUE OF THE DEPENDENT VARIABLE CORRESPONDING
C                    TO THE CALLING ARGUMENT XX (INDEPENDENT VARIABLE)
C     KK - INITIAL PARAMETER
C     I - ADJUSTABLE SUBSCRIPT, ARRAY DIMENSIONING
C     NN - TERMINAL PARAMETER
C          X CONTAINS TABLE VALUES OF INDEPENDENT VARIABLE
C         XX IS THE POINT AT WHICH THE FUNCTION VALUE IS DESIRED.
C          Y MUST BE STORED IN ASCENDING VALUES OF X.
C          I RETURNS THE INDEX OF THE LAST ELEMENT OF X NOT .GT. XX
C            NO TWO NUMBERS OF X MAY BE EQUAL.
C       I RANGES FROM 1 TO N-1
C       GENFN1-FUNCTION SUBROUTINE
C       GENFN1 LINEARLY INTERPOLATES BETWEEN TABULAR XY-PAIR AS A
C  FUNCTION OF THE FORM
C                    Y=F(X)
C  TO DETERMINE THE VALUE OF Y AT A GIVEN X.
C       GENFN1 DOES NOT USE ANY EXTERNAL SUBROUTINES.
C       THERE IS ONE ENTRY POINT TO GENFN1 AND THE CALLING SEQUENCE
C  IS:  GENFN1 (Y,X,XX,N,I)
C  WHERE
C       Y-A TABLE CONTAINING THE DEPENDENT VARIABLE VALUES FOR
C         ASCENDING VALUES OF THE INDEPENDENT VARIABLE X.
C       X=A TABLE CONTAINING VALUES OF THE INDEPENDENT VARIABLE STORED
C         ASCENDING ORDER.
C       XX-A VALUE OF THE INDEPENDENT VARIABLE FOR WHICH THE
C         DEPENDENT VARIABLE IS TO BE COMPUTED.
C       N-THE NUMBER OF VALUES CONTAINED IN TABLES X AND Y ABOVE.
C  I-ON RETURN WILL CONTAIN THE POSITION IN THE X TABLE OF THE LAST
C         VALUE NOT GREATER THAN XX.
C  THE FUNTION GENFN1 IS USED BY THE SUBROUTINES ATTENG, PREPR, PROPDA
C  AND SETPES.
C  THE INPUT TO GENFN1 COMES ENTIRELY FROM THE CALLING ARGUMENTS.
C  GENFN1 HAS ONE EXIT RETURN AT LINE NUMBERED 28 OF THE SUBROUTINE
C  LISTING IN SECTION 7.  THE CALCULATED VALUE OF THE DEPENDENT
C  VARIABLE CORRESPONDING TO THE CALLING ARGUMENT XX IS RETURNED
C  THROUGH THE FUNCTION NAME.  THE ONLY OUTPUT CONSISTS OF THE CALLING
C  ARGUMENT I, PREVIOUSLY DISCUSSED.
```

Function GENFN2

```
      FUNCTION GENFN2 (Z,X,Y,XX,YY,M,N,I,J)
C
C
C     ***********************************************************************
C
C     GENFN2 PERFORMS A 2-D LINEAR INTERPOLATION ON MATRIX Z
C
C     I RANGES FROM 1 TO M-1
C     J RANGES FROM 1 TO N-1
C     NO TWO VALS OF X OR Y OR Y MAY BE EQUAL.
C     I - LAST ELEMENT OF X NOT GREATER THAN XX
C     J - LAST ELEMENT OF Y NOT GREATER THAN YY
C     X CONTAINS VALUES OF 1ST INDEP. VAR. DIMEN M )ASCEND. ORDER
C     Y CONTAINS VALUES OF 2ND INDEP. VAR. DIMEN N)DESCEND. ORD.
C     XGRAD - GRADIENT OF X
C     YGRAD - GRADIENT OF Y
C     XX,YY POINT AT WHICH FUNCTIONAL VALUE IS DESIRED.
C     ZERO VALUES OF Y ARE IGNORED
C     ZY1 - PLANE )NOT A/C( DISPLACEMENT FROM
C     CONTIGUOUS Z TABLE ENTRY
C     ZY2 - AS ZY1, ORTHOGONAL COORD
C
C        GENFN2 DOES A 2-D LINEAR INTERPOLATION ON MATRIX Z
C           X  CONTAINS VALUES OF 1ST INDEP. VAR. DIMEN M (ASCEND. ORDER
C           Y  CONTAINS VALUES OF 2ND INDEP. VAR. DIMEN N (DESCEND. ORD.
C          XX,YY  POINT AT WHICH FUNCTIONAL VALUE IS DESIRED.
C        ZERO VALUES OF Y ARE IGNORED
C        I RANGES FROM 1 TO M-1
C        J RANGES FROM 1 TO N-1
C        NO TWO VALS OF X OR Y MAY BE EQUAL.
C  GENFN2-FUNCTION SUBROUTINE
C  GENFN2 PERFORMS A TWO-DIMENSIONAL LINEAR INTERPOLATION
C  (EXTRAPOLATION) FOR TABULAR XYZ VALUES OF A FUNCTION OF THE FORM
C        Z=F(X,Y)
C  GENFN2 DOES NOT USE ANY EXTERNAL SUBROUTINES.
C  THERE IS ONE ENTRY POINT TO GENFN2 AND THE CALLING SEQUENCE IS:
C        GENFN2 (Z,X,Y,XX,YY,M,N,I,J)
C  WHERE
C        Z-TABULAR VALUES OF THE DEPENDENT VARIABLE
C        X-TABULAR VALUES OF THE FIRST INDEPENDENT VARIABLE STORED IN
C          ASCENDING ORDER.
C        Y-TABULAR VALUES OF THE SECOND INDEPENDENT VARIABLE STORED IN
C          DESCENDING ORDER.
C        XX,YY-VALUES OF THE FIRST AND SECOND INDEPENDENT VARIABLES,
C          RESPECTIVELY, FOR WHICH THE DEPENDENT VARIABLE IS TO BE
C          CALCULATED.
C        M-THE NUMBER OF VALUES IN THE 3X3 TABLE.
C        N-THE NUMBER OF VALUES IN THE 3Y3 TABLE.
C        I-ON RETURN CONTAIN THE POSITION OF THE LAST VALUE IN THE 3X3
C          TABLE THAT IS LESS THAN XX.
C        J-ON RETURN WILL CONTAIN THE POSITION OF THE LAST VALUE IN THE
C          3Y3 TABLE THAT IS LESS THAN YY.
C        THE ONLY SUBROUTINE TO USE GENFN2 IS THE FUNCTION ACNOIS.
C  GENFN2 WILL BE USED MANY TIMES DURING EXECUTION WHEN ENERGY METRICS
C  ARE CALCULATED.
C        ALL INPUT DATA TO GENFN2 IS THROUGH THE CALLING ARGUMENTS.
C        GENFN2 HAS ONLY ONE EXIT RETURN LOCATED AT LINE NUMBER 51 OF
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C  THE SUBROUTINE LISTING IN SECTION 5.
C        THE VALUE OF THE DEPENDENT VARIABLE IS RETURNED TO THE
C  CALLING PROGRAM THROUGH THE FUNCTION NAME.  THE VALUE FOR I AND J



C  ARE RETURNED THROUGH THE CALLING ARGUMENTS AS PREVIOUSLY DISCUSSED.
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Subroutine GRADIE

```
      SUBROUTINE GRADIE (A)

C
C     ******************************************************************
C      LOCAL VARIABLE DICTIONARY
C      A - FIRST TWO ELEMENTS ARE X,Y COORDS OF POINT FOR WHICH EXPOSURE
C                WAS JUST CALCULATED
C      ASCANS - ASDS EXPOSURE VALUES FROM CALLS TO EXPOSE
C      ASCANS - ASDSE (DOSE) EXPOSURE FROM CALLS TO EXPOSE
C      FOLD - ASCANS EXPOSURE FOR FIRST SEARCH POINT
C      GRADU - UNIT VECTOR IN DIRECTION OF GRADIENT
C      GRADMG - GRADIENT MAGNITUDE
C      HOLD - ASCANS EXPOSURE AT A ( AT THE ARGUMENT LOCATION)
C      M2 - METRIC NUMBER FOR GRADIENT CALCULATION
C      NDS - SAME AS NOBS
C      NEY2 - EXPOSURE AT POINT OFFSET FROM A BY 5 FEET
C      NEY3 - EXPOSURE AT POINT OFFSET FROM A BY 5 FEET IN OPPOSITE DIRECTION
C      NOBS - NUMBER OF OBSERVERS
C      NUMPR - NUMBER OF PRIMARY EXPOSURE METRIC
C      TNEY1 - EXPOSURE AT CANDIDATE POINT A
C      VO - TABLE OF TEST POINT LOCATIONS FROM NMASDS
C        GRADIE-SUBROUTINE
C        THE SUBROUTINE GRADIE IS USED TO COMPUTE THE APPROXIMATION OF
C  A LOCAL NOISE EXPOSURE GRADIENT UNIT VECTOR AT A GIVEN POINT FOR
C  WHICH THE NOISE EXPOSURE VALUE, USING ALL DEFINED FLIGHTS, HAS JUST
C  BEEN COMPUTED.
C        GRADIE USES THE SUBROUTINE EXPOSE, VMAG AND VTRN.
C        THERE IS ONLY ONE ENTRY POINT TO GRADIE AND THE CALLING
C  SEQUENCE IS:
C              CALL GRADIE (A)
C  WHERE
C        A-A VARIABLE OF DIMENSION 2 FOR WHICH THE FIRST TWO POSITIONS
C          DEINE THE XY-COORDINATES OF THE POINT AT WHICH THE NOISE
C          EXPOSURE WAS JUST CALCULATED.
C        GRADIE IS CALLED BY THE SUBROUTINE FIRST AND THE MAIN PROGRAM
C  NOISE1.  IT WILL BE CALLED MANY TIMES DURING EXECUTUION.
C        THE DATA INPUT TO GRADIE IS THROUGH THE CALLING ARGUMENT,
C  PREVIOUSLY DISCUSSED, AS WELL AS LABLED COMMON BLOCK.  THE FOLLOWING
C  DESCRIBES THE INPUT VIA THE COMMON BLOCKS.
C        LABEL    VARIABLE  DESCRIPTION
C        /GRDBLK/ ASCANS    ASDS AND DOSE NOISE EXPOSURE VALUES FROM
C                 ASCANS    CALLS TO EXPOSURE BY GRADIE.
C        /METRIC/ NUMPR     NUMBER OF PRIMARY METRIC.
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C       GRADIE HA  ONLY ONE EXIT RETURN L. ATED AT LINE NUMBERED 35 IN
C  THE SUBROUTINE LISTING IN SECTION 5.
C       THE OUTPUT FROM GRADIE IS THROUGH THE LABLED COMMON BLOCK
C  /GRADNT/.  THE XY-COORDINATE COMPONENTS FOR A UNIT VECTOR POINTING
C  IN THE DIRECTION OF MAXIMUM  . REASE IN EXPOSURE ARE CONTAINED IN
C  THE FIRST TWO POSITIONS OF THE VARIABLE GRADU.  THE MAGNITUDE OF THE
C  COMPUTED LOCAL GRADIENT VECTOR IS STORED IN THE VARIABLE GRADMG AND
C  THE UNITS ARE IN NE PER  OOT, WHERE NE CORRESPONDS TO NEF,IDN,CNEL,
C  LEQ, MINUTES OR PERCENT DEPENDING ON THE PRIMARY METRIC.
C       THE SUBROUTINE GRADIE IS USED TO COMPUTE THE APPROXIMATION OF
C  A LOCAL GRADIENT UNIT VECTOR AT A GIVEN POINT FOR WHICH A NOISE
C  EXPOSURE VALUE HAS BEEN COMPUTED.  FIRST THE GRADIENT VECTOR IS
C  COMPUTED AND THEN THE COMPONENTS ARE DIVIDED BY THE MAGNITUDE
C  CONVERTING TO A UNIT VECTOR.
C
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Subroutine HBT

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      SUBROUTINE HBT (R0),'T,'M'T,M'X1,M'X2,DT,DIT,D3,D5,D1S,DB)

C

      ********** ********************************************************
C       LOCAL VARIABLE DICTION
C       AX - X COORDS OF BOARD SURFACE POINTS (BEGINNING OF RWY)

C     AXY - TRACK SEGMENT NUMBER OF ANGLE BISECTOR )CLOSEST SEG CURVED(
C       BIG - DIAMOND MASK, USED IN (?)
C       D - DUMMY VARIABLE FOR CALLS TO CURVE; ALSO DISTANCE BETWEEN
C             TWO POINTS ON SEGMENT CLOSEST TO ORIGIN
C       DA - NOISE LEVEL CORRECTION (MAX1 GEOMETRY,0 FOR STRAIGHT SEGS)
C       DAB - NOISE LEVEL CORRECTION
C       DAS - DISTANCE ALONG SEGMENT FROM FAR END OF RUNWAY
C       DAT - DISTANCE ALONG TRACK FROM BEGINNING OF RUNWAY
C       DB - NOISE LEVEL CORRECTION (MAX2 GEOMETRY,) FOR STRAIGHT SEG)
C       DM - DISTANCE TO SEGMNT OF TRACK CLOSEST ORIGIN
C      DMIN         FOR EACH TRACK, THE LENGHT OF THE SHORTEST STRAIGHT
C                   OF ONE-HALF THE MINIMUM TURN RADIUS, WHICHEVER IS
C                   SMALLEST.
C       DS - DISTANCE FROM ORIGIN TO SECOND CLOSEST SEGMENT ON TRACK
C       DT - DISTANCE FROM ORIGIN TO CLOSEST SEGMENT ON TRACK
C       DX - 1/3 OF DM; DEFINES INNER BOUNDARY OF CURVED SEGMENT
C       F - MAGNITUDE OF NOISE ALONG ANGLE BISECTOR
C       G - NOISE LEVEL CORRECTION FOR SEGMENT BOUNDARIES
C       IAA - LOOP COUNTER
C     IGC - ERROR FLAG
C                   ITSEG.  (ALSO USED BY OTHER SUBROUTINES.)
C        ITSEG      CONTAINS THE NUMBER OF TRACK SEGMENTS FOR A GIVEN
C                   TRACK IN THE LOW ORDER 5 BINARY BITS OF THE WORD.
C                   THE HIGH ORDER 17 BITS CONTAIN INFORMATION
C                   REGARDING THE TRACK SEGMENTS FOR A GIVEN TRACK.  IF
C                   THE BIT IN POSITION A, COUNTING FROM HIGH ORDER TO
C                   LOW ORDER, IS A BINARY 0, THEN THE SEGMENT NUMBER A
C                   IS A STRAIGHT SEGMENT.  IF THE BIT IS A BINARY 1,
C                   THE CORRESPONDING SEGMENT IS A TURN (I.E., CIRCULAR
C                   SEGMENT).
C     K - DUMMY VARIABLE FOR CLOSEST SEGMENT NUMBER
C     M - DUMMY VARIABLE FOR SECOND CLOSEST SEGMENT NUMBER
C        MASK       MASKING CONSTANTS USED TO RETRIEVE INFORMATION FROM
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C       MAX1 - RUNWAY NUMBER OF PRIMARY NOISE CONTRIBUTOR(CLOSEST SEG)
C       MAX2 - RWY NUM OF SECONDARY CONTRIB
C       MAXS - TABLE OF RWY NUMBERS INDEXED BY TRACK NUMBER FOR
C              PRIMARY CONTRIBUTOR
C       MAXT - AS MAXS FOR SECONDARY CONTRIB
C       MID - DISTANCE TO POINT MIDWAY BETWEEN TWO CLOSEST SEGMENTS
C       NS - NUMBER OF SEGMENTS IN TRACK
C       NT - TRACK NUMBER
C       NTS - SEGMENT NUMBER FOR TRACK NT
C       NTST - FLAG; 2=CLOSEST SEGMENT KNOWN
C       PARAM - SEE ABOVE
C       P00 - CURRENT POINT
C       RX - NOISE LEVEL CORRECTION AT BISECTOR (MID)
C       S1 - DISTANCE FROM POINT TO MAX1
C       S2 - DISTANCE FROM POINT TO MAX2
C       S1 - DIFFERENCE VECTOR BETWEEN R00 AND AX
C      TTD         THE TOTAL DISTANCE FROM THE BEGINNING OF A TRACK,
C                  INCLUDING RUNWAY LENGHT, TO THE END OF EACH SEGMENT
C                  EXCEPT THE LAST ONE, FOR EACH TRACK.
C       X - DUMMY VARIABLE FOR CALLS TO CURVE (DISTANCE ALONG SEG)
C       XI - 0 UNLESS CLOSEST SEGMENT IS CURVED
C       XL1 - LENGTH OF CLOSEST SEGMENT
C       XL2 - LENGTH OF SECOND CLOSEST SEGMENT
C       XX - DISTANCE ALONG SEGMENT SELECTED FOR CORRECTION (DEPENDS
C               ON GEOMETRY OF SEG; ALONG MAX2 TO CLOSEST APPROACH
C               FOR  LOOPED TURN, ALONG SHORTER SEG FOR HAIRPIN
C       YY - AS XX FOR ANOTHER SITUATION ?
C     HBT-SUBROUTINE
C     THE ROUTINE HBT COMPUTES A VARIETY OF QUANTITIES ASSOCIATED WITH
C GROUND TRACK GEOMETRY.
C     HBT USES THE FUNCTIONS AND SUBROUTINES CONTF, CONTG, CURVE,
C STRAIT, VMAG AND VSUB.
C     THE SUBROUTINE HBT HAS ONLY ONE ENTRY POINT AND THE CALLING
C SEQUENCE IS:
C     CALL HBT (P0,PT,NTST,MAX1,MAX2,DT,DAT,DA,DS,DAS,DB)
C WHERE
C       P/-1 VARIABLE OF DIMENSION 3 OR MORE, THE FIRST TWO POSITIONS
C         OF WHICH ARE THE VALUES OF THE X- AND Y-COORIDINATES OF THE
C         ANALYSIS POINT, RESPECTIVELY.
C       NT-THE GROUND TRACK NUMBER.
C       NTST-INDICATES WHETHER CLOSEST SEGMENT TO ANALYSIS POINT IS
C         KNOWN.  IF NTST=2, CLOSEST SEGMENT IS KNOWN NTST-2, HBT MUST
C         FIND THE CLOSEST SEGMENT.
C       MAX1-THE NUMBER OF THE CLOSEST SEGMENT.  THIS IS RETURNED BY
C         HBT TO THE CALLING PROGRAM.
C       MAS2*-THE NUMBER OF THE NEXT TO CLOSEST SEGMENT.  RETURNED BY
C         HBT TO THE CALLING PROGRAM.
C       DT-THE DISTANCE FROM THE ANALYSIS POINT TO THE POINT OF
C         CLOSEST APPROACH ON THE TRACK.
C       DAT-THE DISTANCE FROM THE BEGINNING OF THE TRACK, RUNWAY
C         INCLUDED, TO THE POINT OF CLOSEST APPROACH.
C       DA-CORRECTION TO NOISE LEVEL COMPUTED FOR SITUATION FOR
C         SEGMENT MAX1 DUE TO GEOMETRIC CONSIDERATIONS.
C       DS-DISTANCE FROM THE ANALYSIS POINT TO THE NEXT CLOSEST
C         SEGMENT (MAX2).
C       DAS-THE DISTANCE FROM THE BEGINNING OF THE TRACK, RUNWAY TO
C         THE POINT ON MAX2 THAT IS CLOSEST TO THE ANALYSIS POINT.
C       DB-CORRECTION TO NOISE LEVEL COMPUTED FOR THE SITUATION AT THE
C         CLOSEST POINT ON MAX2 DUE TO GEOMETRIC CONSIDERATIONS.
C       *THESE VALUES ARE ONLY COMPUTED BY HBT IF IT IS DETERMINED BY
C         HBT THAT THE NOISE COMING FROM A SECTION WILL SIGNIFICANTLY
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C          ADD TO THE NOISE PRODUCED BY THE NORMAL CALCULATION USING
C          THE VARIABLES COMPUTED AT THE POINT OF CLOSEST APPROACH.
C        THE ONLY PROGRAM TO USE THE SUBROUTINE HBT IS THE FUNCTION
C  PURPOSE.  HBT WILL BE CALLED MANY TIMES DURING EXECUTION.
C        ALL VARIABLE INPUT DATA IS PROVIDED TO HBT THROUGH THE CALLING
C  ARGUMENTS RO, HT AND HTST.  FIXED DATA IS ALSO ACCESSED FROM LABELED
C  COMMON BLOCK/TRACK/.  THE FOLLOWING DESCRIBES THE TABULAR DATA
C  STORED IN THE BLOCK.
C        VARIABLE  DESCRIPTION
C        ATP       CONTAINS RUNWAY NUMBERS ASSOCIATED WITH EACH TRACK.
C        ITSEG     CONTAINS THE NUMBER OF TRACK SEGMENTS FOR A GIVEN
C                  TRACK IN THE LOW ORDER 5 BINARY BITS OF THE WORD.
C                  THE HIGH ORDER 15 BITS CONTAIN INFORMATION
C                  REGARDING THE TRACK SEGMENTS FOR A GIVEN TRACK.  IF
C                  THE BIT IN POSITION A, COUNTING FROM HIGH ORDER TO
C                  LOW ORDER, IS A BINARY 0, THEN THE SEGMENT NUMBER A
C                  IS A STRAIGHT SEGMENT.  IF THE BIT IS A BINARY 1,
C                  THE CORRESPONDING SEGMENT IS A TURN (I.E., CIRCULAR
C                  SEGMENT).
C        MASK      MASKING CONSTANTS USED TO RETRIEVE INFORMATION FROM
C                  ITSEG.  (ALSO USED BY OTHER SUBROUTINES.)
C
C        PARAM     INFORMATION REGARDING EACH SEGMENT IN EACH TRACK.
C                  FOR TRACK NUMBER J AND SEGMENT NUMBER I
C
C                       IF THE SEGMENT IS STRAIGHT
C
C                  PARAM(1,I,J,) = THE X-COORDINATE OF THE START OF THE
C                  SEGMENT.
C                  PARAM(2,I,J) = THE Y-COORDINATE OF THE START OF THE
C                  SEGMENT.
C                  PARAM(3,I,J) = THE LENGHT OF THE SEGMENT.
C                  PARAM(4,I,J) = THE X-COMPONENT OF A UNIT VECTOR
C                  POINTING IN THE DIRECTION OF THE SEGMENT.
C                  PARAM(5,I,J) = THE Y-COMPONENT OF THE UNIT VECTOR
C                  DESCRIBED ABOVE.
C                       IF THE SEGMENT IS CIRCULAR
C                  PARAM(1,I,J) = X-COORDINATE OF THE CENTER OF THE
C                  CIRCLE.
C                  PARAM(2,I,J) = Y-COORDINATE OF THE CENTER OF THE
C                  CIRCLE.
C                  PARAM(3,I,J) = RADIUS OF CURVATURE, NEGATIVE FOR
C                  RIGHT TURNS, POSITIVE FOR LEFT.
C                  PARAM(4,I,J) = TURN ANGLE IN RADIANS.
C                  PARAM(5,I,J) = ANGLE BETWEEN A LINE JOINING THE
C                  CENTER WITH THE START OF THE TURN AND A LINE
C                  POINTING IN THE POSITVE X DIRECTION.
C        TOD       THE TOTAL DISTANCE FROM THE BEGINNING OF A TRACK,
C                  INCLUDING RUNWAY LENGHT, TO THE END OF EACH SEGMENT
C                  EXCEPT THE LAST ONE, FOR EACH TRACK.
C        DMIN      FOR EACH TRACK, THE LENGHT OF THE SHORTEST STRAIGHT
C                  OR ONE-HALF THE MINIMUM TURN RADIUS, WHICHEVER IS
C                  SMALLEST.
C     THE SUBROUTINE HBT HAS TWO EXIT RETURNS LOCATED AT LINES
C  NUMBERED 154 AND 156 IN THE SUBROUTINE LISTING IN SECTION 5.  THE
C  RETURN AT LINE NUMBER 154 IS TAKEN IF THE FIRST SEGMENT IS THE
C  CLOSEST TO THE ANALYSIS POINT.  OTHERWISE, THE RETURN AT LINE 156
C  IS USED.
C     THE OUTPUT FROM HBT IS THROUGH THE CALLING ARGUMENTS AS
C  PREVIOUSLY DISCUSSED.  IN ADDITION, THE VARIABLE NTS IN THE LABELED
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C  COMMON BLOCK/THOBLOK/IS SET EQUAL TO THE NUMBER OF TRACK SEGMENTS IN
C  THE CURRENT TRACK BEING ANALYZED.  THIS COMMON BLOCK WILL BE USED BY
C  SUBROUTINE OVRLAY IF ASDS OR DOSE VALUES ARE CALCULATED.
C   SUBROUTINE HRT COMPUTES THE FOLLOWING QUANTITIES:
C  .   THE SHORTEST DISTANCE FROM A GIVEN POINT TO A GIVEN GROUND TRACK
C  .   THE SEGMENT NUMBER, IN THE TRACK DEFINITION, FOR THE SEGMENT
C      CLOSEST TO THE GIVEN POINT.
C  .   THE DISTANCE FROM THE BEGINNING OF THE TRACK TO THE POINT OF
C      CLOSEST APPROACH TO THE GIVEN POINT.
C  .   THE NUMBER OF ANY SECONDARY SEGMENT ON THE TRACK, FOR WHICH THE
C      NOISE CONTRIBUTION MAY BE SIGNIFICANT, ALONG WITH THE DISTANCE
C      TO THE SECONDARY SEGMENT AND THE DISTANCE FROM THE BEGINNING OF
C      THE TRACK TO THE POINT OF CLOSEST APPROACH IN THE SECONDARY
C      SEGMENT.
C  .   THE NOISE EXPOSURE CORRECTION VALUES FOR TRACK GEOMETRY
C  THE DISTANCE TO THE SEGMENTS ARE COMPUTED BY THE SUBROUTINES STRAIT
C  OR CURVE DEPENDING ON WHETHER THE SEGMENT IS STRAIGHT OR CIRCULAR.
C  HRT CALLS THESE SUBROUTINES TO PROCESS THE SEGMENTS AS NEEDED AND
C  DETERMINES THE CLOSEST AND NEXT TO CLOSEST SEGMENTS TO THE ANALYSIS
C  POINT, THE DISTANCE TO AND ALONG THE SEGMENT.  THE FOLLOWING
C  PARAGRAPHS DESCRIBE THE NOISE EXPOSURE CORRECTION VALUES COMPUTED
C  FOR TRACK GEOMETRY.
C      THERE ARE TWO REASONS FOR THE DEVELOPMENT OF THE FOLLOWING
C  ALGORITHMS.  BEFORE THESE WERE DEVELOPED, THE NOISE WAS COMPUTED
C  USING ONLY THE CLOSEST TRACK SEGMENT.  THUS, IF A TRACK MADE A LARGE
C  TURN SO THAT, IN SOME REGIONS, TWO SEGMENTS OF THE SAME TRACK ARE
C  CLOSE TO THE POINT OF COMPUTATION, SEVERE DISCONTINUITIES CAN APPEAR
C  IN THE NOISE FUNCTION.
C  THESE CORRECTIONS REMOVE (OR REDUCE TO INSIGNIFICANCE) THOSE
C  DISCONTINUITIES.  ALSO, THE SINGLE EVENT NOISE DATA IN THE PROGRAM
C  ARE FOR A SINGLE STRAIGHT FLYOVER.  CONSEQUENTLY, IF THE FLIGHT
C  TRACK IS CURVED, THE ACTUAL NOISE EXPOSURE WILL BE GREATER ON THE
C  INSIDE OF THE TURN, AND LESS ON THE OUTSIDE, THAN THAT OBTAINED FROM
C  THE STORED TABLES.  THESE FACTORS WILL CORRECT FOR THE INSIDE OF THE
C  TURN ONLY.
C      MAX1 =SEGMENT NUMBER OF THE CLOSEST SEGMENT.
C      MAX2 =SEGMENT NUMBER OF THE NEXT CLOSEST SEGMENT.
C      S1 =DISTANCE FROM THE POINT TO MAX1.
C      S2 =DISTANCE FROM THE POINT TO MAX2.
C      D =S2-S1
C      DM =LENGHT OF THE SHORTEST SEGMENT OF THE TRACK OR 1/2 THE
C      SMALLEST TURN RADIUS, WHICHEVER IS LESS.
C      DX =DM/3
C      G(D) =(D/DM)**2
C      DA =THE DB CORRECTION IN DECIBELS TO BE ADDED ARITHMETICALLY TO
C      THE NOISE COMPUTED FROM SEGMENT MAX 1.
C      DB =THE DB CORRECTION IN DECIBELS FROM SEGMENT MAX 2.
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Subroutine HEADER

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      SUBROUTINE HEADER (NPT,XX,YY,AREA,PLTS,PCNT,IT)
C
C     ****************************************************************
C      HEADER-SUBROUTINE
C      SUBROUTINE HEADER PRINTS THE COLUMN HEADING FOR THE PRINTOUT OF
C  CONTOUR POINTS AND VALUES.  THE FORMATS FOR THE HEADINGS ARE
C  VARIABLE SINCE MORE THAN ONE METRIC MAY BE OPTIONALLY SELECTED.
C  HEADER ALSO SETS UP THE PRINT FORMATS FOR ITSELF AND SUBROUTINE
C  PLINE WHICH PRINTS THE DATA LINES.
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C      THE SUBROUTINE HEADER USES NO EXTERNAL SUBROUTINES.
C      THE SUBROUTINE HEADER HAS TWO ENTRY POINTS, HEADER AND PLINE.
C  THE FOLLOWING IS THE CALLING SEQUENCE FOR HEADER:
C                  CALL HEADER (IND)
C  WHERE
C        IND - AN INTEGER VALUE WHICH, IF EQUAL TO ZERO, INDICATES THAT
C            , HEADER AND DATA LINE FORMAT MUST BE DETERMINED AND SET
C              UP.  IF NOT ZERO, THE HEADING BLOCK IS PRINTED AS
C              PRESENTLY DEFINED.
C      THE SUBROUTINE METFIX MAKES THE INITIAL CALL TO HEADER TO SET UP
C  THE OUTPUT FORMAT STATEMENTS FOR THE COLUMN TITTLES AND THE DATA
C  LINE.  THE REMAIN NOISE1 MAKES ANY SUBSEQUENT CALLS AS NEEDED
C  WHENEVER A NEW PAGE OF CONTOUR DATA OUTPUT IS BEGUN.
C      THE ONLY INPUT HEADER IS THE CALLING VARIABLE IND; ALL OTHER
C  NECESSARY DATA IS CONTAINED IN HEADER.
C      THERE IS ONLY ONE EXIT RETURN FROM HEADER LOCATED AT LINE NUMBER
C  '31' IN THE SUBROUTINE LISTING IN SECTION 5.
C      THE OUTPUT FROM HEADER IS TO THE LINE PRINTER AND NO INFORMATION
C  IS RETURNED TO THE CALLING PROGRAM.
C      THE PROCESSING PERFORMED BY HEADER CONSISTS OF CONSTRUCTING
C  "FORMAT" STATEMENTS FOR FUTURE HEADER AND DATA LINE PRINTOUTS.  THE
C  VARIABLES USED BY HEADER ARE ALL FULL WORD HOLLERITH DATA AND
C  POSITIONED BY HEADER DEPENDING ON THE PRIMARY METRIC, WHICH IS
C  PRINTED FIRST, AND ANY ALTERNATE METRICS, WHICH ARE PRINTED ON THE
C  SAME LINE AND TO THE RIGHT OF THE PRIMARY METRIC IN THE ORDER OF
C  THEIR ASSIGNED NUMBER (SEE SUBROUTINE ACNOIS).  IN ADDITION, THE
C  NUMBER OF METRICS (N) TO BE PRINTED, A TABLE (INDX) CONTAINING THE
C  ORDER IN WHICH THE METRIC VALUES ARE TO BE PRINTED ARE CONSTRUCTED
C  FOR LATER USE BY PLINE.
C      A SECOND ENTRY POINT FOR SUBROUTINE HEADER IS AT PLINE AND THE
C  CALLING ARGUMENT IS:
C                CALL PLINE (NPT,X,Y,AREA,FITS,PCNT,IT)
C  WHERE
C      NPT - THE NUMBER OF THE CURRENT CONTOUR POINT.  IF NPT IS EQUAL
C            TO ZERO, A SINGLE LINE OF MINUS SIGNS IS OUTPUT TO THE
C            LINE PRINTER TO TERMINATE THE PAGE AND NO OTHER ACTION
C            TAKES PLACE.
C        X - THE X-COORDINATE OF THE CONTOUR POINT.
C        Y - THE Y-COORDINATE OF THE CONTOUR POINT.
C     AREA - THE CUMULATIVE AREA UP TO THIS POINT.
C    FITS* - THE NUMBER OF SIGNIFICANT BITS USED WHEN SEARCHING FOR
C            THIS POINT.
C    PCNT* - THE PERCENTAGE OF THE NOISE THAT THE NUMBER OF SIGNIFICANT
C            BITS REPRESENTED.
C       IT* - THE NUMBER OF TIMES THE SUBROUTINE EXPOSE WAS USED SINCE
C            THE LAST POINT WAS FOUND.
C      *NOTE THESE ARE DIAGNOSTIC VALUES WHICH CAN BE INFORMATIVE IF
C      SOMETHING GOES WRONG DURING EXECTION.
C      THE REMAIN PROGRAM NOISE1 IS THE ONLY USER OF THE ENTRY AT
C  PLINE.  IT IS USED TO PRINT A DATA LINE OR TERMINATE A PAGE OF
C  OUTPUT.
C      THE INPUT DATA PROVIDED BY THE CALLING ARGUMENTS IS COMPLETE



C  EXCEPT FOR THE METRIC VALUES.  THESE ARE RETRIEVED FROM THE TABLE
C  VALUES IN LABLED COMMON BLOCK /METPIC/.  NOTE THAT THE TABLE VALUES

C  IS IDENTICAL TO THE TABLE AVALS USED IN SOME OF THE OTHER
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C  SUBROUTINES.
C
C      THERE ARE TWO "EXIT" RETURNS FROM PLINE LOCATED AT LINES NUMBERED
C  ***  AND ***  IN THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT
C  LINE *** IS USED WHEN A PAGE IS TERMINATED WHILE THE RETURN AT LINE
C  *** IS USED AFTER A DATA LINE HAS BEEN PRINTED.
C      THE ONLY OUTPUT FROM PLINE IS TO THE LINE PRINTER AND NO
C  INFORMATION IS RETURNED TO THE CALLING PROGRAM.
C      THE ONLY PROCESSING PERFORMED BY PLINE CONSISTS OF STORING THE
C  METRIC VALUES IN A TEMPORARY TABLE IN THE ORDER IN WHICH THEY WILL
C  BE OUTPUT.
C
```

Subroutine HELG

```
      SUBROUTINE HELG (KXX,NSX,XLX,UNIT,XR1,A)
C
C     ********************************************************************
C      LOCAL VARIABLE DICTIONARY
C
C     A - RADIUS OF CURVATURE
C
C     ARP - RADIANS OF ARC
C      DELT - ANGLE BETWEEN POSISITVE X DIRECTION AND A LINE JOINING
C                 THE CENTER OF THE CURVE WITH THE BEGINNING OF THE TURN
C     KXX - RUNWAY NUMBER
C     NSX - TRACK NUMBER
C      PARAM - INDICATES TRACK SEGMENT POSITION
C      Q1 - PROJECTION OF TURN STARTING X COORD INTO GROUND TRACK PLANE
C      Q2 - PROJECTION OF TURN STARTING Y COORD INTO GROUND TRACK PLANE
C     UNIT - UNIT VECTOR, DIRECTION IS TOWARDS STARTING POINT OF TURN
C     " - NEGATIVE OF SIGN OF A
C     XLX - ARC LENGTH
C     XR1 - PROJECTION OF EXPOSURE POINT ONTO PLANE OF GROUND TRACK
C      XX - SIGNED COMPONENT OF UNIT VECOTR IN DIRECTION OF TURN
C      YY - SIGNED COMPONENT OF UNIT VECOTR IN DIRECTION OF TURN
C      HELG SUBROUTINE
C      HELG COMPUTES THE CIRCULAR SEGMENT VARIABLES FROM TRACK
C  DEFINITIONS IN THE INPUT DATA (SEE SUBROUTINE HBT, VARIABLE PARAM).
C      THE SUBROUTINE USES THE EXTERNAL SUBROUTINE SGNP.
C      THERE IS ONLY ONE ENTRY TO HELG AND THE CALLING SEQUENCE IS
C      CALL HELG (KXX,NSX,XLX,UNIT,XR1,A)
C  WHERE
C        KXX - THE TRACK NUMBER
C        NSX - THE NUMBER OF THIS SEGMENT
C        XLX - THE ARC LENGHT OF THE SEGMENT IN FEET
C       UNIT - A UNIT VECTOR TANGENT TO THE END POINT (NOT THE START
C              POINT) OF THE LAST SEGMENT.  UNIT IS OF DIMENSION 3 OR
C              MORE, THE FIRST TWO POSTIONS OF WHICH CONTAIN THE VALUES
C              OF THE X- AND Y- COMPNENTS OF THE UNIT VECTOR.
C        XR1 - A VARIABLE OF DIMENSION 3 OR MORE, THE FIRST TWO
C              POSITIONS OF WHICH CONTAIN THE X- AND Y- COORDINATE OF
C              THE END POINT OF THE LAST SEGMENT.
C          A - THE RADIUS OF CURVATURE IN FEET.  THE SIGN OF A IS
C              POSITIVE FOR A RIGHT TURN NEGATIVE FOR A LEFT TURN WHEN
C              DEFINING THE TRACK FROM THE RUNWAY OUT, IRRESPECTIVE OF
C              THE FLIGHT DIRECTION.
C      THE ONLY SUBROUTINE TO USE HELG IS TRAKRD.  HELG IS USED IN
C  CONJUNCTION WITH XLINE TO DEFINE GROUND TRACK GEOMETRY AND MAY BE
C  USED MANY TIMES DURING THE INPUT PHRASE OF EXECUTION.
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C      THE INPUT IS THROUGH THE CALLING ARGUMENTS.
C      THERE IS ONE EXIT RETURN FROM HELG AT LINE NUMBERED 20 IN THE
C  SUBROUTINE LISTING IN SECTION 7.  THIS RETURN IS USED UNDER ALL
C  CIRCUMSTANCES.
C      THE OUTPUT DATA FROM HELG IS PASSED THROUGH THE CALLING
C  ARGUMENTS.  IN ADDITION, APPROPRIATE LOCATIONS IN THE VARIABLE PARAM
C  LABELED COMMON BLOCK /TRACK/ ARE INITIALIZED.
C      THE SUBROUTINE HELG COMPUTES THE XY-COORDINATES OF THE CENTER OF
C  THE CIRCLE OF WHICH THIS SEGMENT IS A PART, THE SIGNED RADIUS OF
C  CURVATURE, THE ANGULAR DISPLACEMENT OF THE SEGMENT AND THE ANGLE
C  BETWEEN THE POSITIVE X-DIRECTION AND A LINE JOINING THE CENTER OF
C  THE START POINT OF THE TURN.
C      THE XY-COORDINATE OF THE CENTER ARE COMPUTED IN THE FOLLOWING
C  MANNER
C  LET
C      W=-A/ABS(A), WHERE A IS THE CALLING ARGUMENT AS DEFINED

C      B=ABS(A)
C  X= UNIT (1).W,WHERE UNIT IS THE CALLING
C      Y= UNIT (2).W ARGUMENT AS DEFINED
C      X = XR1(1)-(B)(Y), WHERE XR1 IS THE CALLING
C      YC = XR1(2)+(B)(X) ARGUMENT AS DEFINED
C  AND (XC,YC) ARE THE COORDINATES OF THE CENTER.
C      THE SIGNED RADIUS OF CURVATURE IS SIMPLY -A SINCE THE CALLING
C  ARGUMENT IS SIGNWISE BACKWARDS MATHEMATICALLY.
C      THE ANGULAR DISPLACEMENT OF THE SEGMENT IS THE ARC LENGHT
C  DIVIDED BY THE RADIUS AND IS EXPRESSED IN RADIANS
C                  ALP=XT*X/ABS(A)
C      FINALLY, THE ANGLE BETWEEN THE POSITIVE X-DIRECTION AND A LINE
C  JOINING THE CENTER OF THE CIRCLE WITH THE BEGINNING OF THE TURN CAN
C  BE EXPRESSED AS FOLLOWS
C                  DELT=ARCTANGENT -X/Y
C  WHERE   X AND Y ARE AS PREVIOUSLY DEFINED.
C      TO COMPUTE THE COORDINATES OF THE END POINT OF THIS SEGMENT THE
C  VARIABLE XR1 IS MODIFIED AND RETURNED AS FOLLOWS
C        XR1 (1) = YC + B COS (W.ALP + DELT)
C        XR1 (2) = YC + B SIN (W.ALP + DELT)
C  THE NEW TANGENT UNIT VECTOR IS COMPUTED AND RETURNED TO THE CALLING
C  PROGRAM BY MODIFYING THE CALLING VARIABLE UNIT AS FOLLOWS
C      UNIT (1) = -W SIN (W.ALP + DELT)
C      UNIT (2) = -W COS (W.ALP + DELT)
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Subroutine INFORM

```
      SUBROUTINE INFORM(MODAPP,MODPRF,MODNC,MODDEF)                    05-30-79
C THIS SUBROUTINE GENERATES A MESSAGE TO INFORM ANYONE                 05-30-79
C READING THE OUTPUT OF THE MODEL THAT THE USER HAS MODIFIED           05-30-79
C THE AIRCRAFT DATA IN THE DATABASE OR HAS CREATED HIS OWN             05-30-79
C AIRCRAFT DEFINITIONS.                                                05-30-79
C THIS SUBROUTINE IS CALLED FROM SUBROUTINE READIN                     05-30-79
C RIGHT BEFORE RETURN TO THE MAIN PROGRAM.                             05-30-79
C                                                                      05-30-79
C     VARIABLE DICTIONARY                                              05-30-79
C     -------- ----------                                              05-30-79
C IAND   - CONTAINS THE WORD 'AND'                                     05-30-79
C ICON   - CONTAINS CONNECTOR FOR MULTIPLE PREDICATE                   05-30-79
C ISIM   - TOTAL NUMBER OF PREDICATES                                  05-30-79
C MAPP   - PREDICATE PERTAINING TO APPROACH PARAMETERS                 05-30-79
C MESS   - THE ENTIRE MESSAGE IF ONLY REDEFINITION OF A                05-30-79
C          DATABASE AIRCRAFT WITHOUT USING ANYTHING OUTSIDE            05-30-79
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C           OF THE DATABASE.                                              05-30-79
C MODAPP  - INDICATOR. IF 1 APPROACH PROFILES HAVE BEEN INPUT             05-30-79
C MODDEF  - INDICATOR. IF 1 AIRCRAFT DEFINITIONS HAVE BEEN INPUT          05-30-79
C MODNC   - INDICATOR. IF 1 NOISE CURVES HAVE BEEN INPUT                  05-30-79
C MODPRF  - INDICATOR. IF 1 TAKEOFF PROFILES HAVE BEEN INPUT              05-30-79
C MNC     - PREDICATE PERTAINING TO NOISE CURVES                          05-30-79
C MPRF    - PREDICATE PERTAINING TO TAKEOFF PROFILES                      05-30-79
C                                                                         05-30-79
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Function INSIDE

```
      LOGICAL FUNCTION INSIDE (P,X,Y,N)

C     ******************************************************************
C     LOCAL VARIABLE DICTIONARY
C     INSIDE - TRUE IF POINT WITHIN DEFINED CONTOUR, FALSE IF OUTSIDE
C
C     J - SELECTION FLAG (SEE LINE 110)
C     N - NUMBER OF POINTS IN CONTOUR
C     P - FIRST TWO LOCATIONS ARE X AND Y COORDS OF POINT IN QUESTION
C     PX - X VALUE OF POINT
C     PY - Y VALUE OF POINT
C     SLOPE - SLOPE OF LINE BETWEEN CONTOUR POINTS CLOSEST TO P
C     X - ARRAY OF X COORDS REPRESENTING CLOSED CONTOUR
C     Y - ARRAY OF Y COORDS REPRESENTING CLOSED CONTOUR
C     YINT - INTERCEPT OF PROJECTION OF P ONTO LINE OF SLOPE
C     YY - VALUE ON LINE FOR WHICH X EQUALS PX
C
C THIS FUNCTION DETERMINES IF THE POINT P(P(1),P(2)) IS WITHIN THE CLOSE
CONTOUR WHICH IS DEFINED BY THE X AND Y ARRAYS OF N VALUES EACH.
C
C IF P IS CONTAINED WITHIN THE CONTOUR INSIDE=.TRUE., OTHERWISE  INSIDE
C
C                  X-VALUE OF POINT IN QUESTION.
C
C     INSIDE LOGICAL FUNCTION SUBROUTINE
C     INSIDE DETERMINES WHETHER OR NOT A GIVEN POINT IS WITHIN A GIVEN
C CLOSED CONTOUR DESCRIBED BY THE COORDINATES OF THE POINTS ON THE
C CONTOUR.
C     INSIDE DOES NOT USE ANY EXTERNAL SUBROUTINES.
C     THERE IS ONLY ONE ENTRY TO INSIDE AND THE CALLING SEQUENCE IS
C                  INSIDE (P,X,Y,N)
C WHERE
C     P - A VARIABLE OF DIMENSION 2 OR MORE, THE FIRST TWO POSITIONS
C         OF WHICH ARE THE VALUES OF THE X- AND Y- COORDINATES OF THE
C         POINT IN QUESTION.
C     X - A VARIABLE OF DIMENSION N OR MORE CONTAINING THE
C         X-COORDINATES OF THE CLOSED CONTOUR IN THE FIRST N
C         POSITIONS.
C     Y - A VARIABLE OF DIMENSION N OR MORE CONTAINING THE
C         Y-COORDINATES CORRESPONDING TO THE X-COORDINATES ABOVE IN
C         THE FIRST N POSITIONS.
C     N - THE NUMBER OF POINTS IN THE CONTOUR.
C     PROGRM IS THE ONLY SUBROUTINE TO USE THE FUNCTION INSIDE AND WILL
C DO SO IF REQUESTED BY THE USER TO LOOK FOR THE OCCURRENCE OF
C DISJOINT CLOSED CONTOURS HAVING THE SAME METRIC VALUE (I.E., NEF 50,
C CNEL 80, ECT.).  THIS CAN HAPPEN WHEN THE CONTOURS ARE VERY SMALL
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C  AND THERE ARE ISOLATED (NONCROSSING) RUNWAYS AT THE AIRPORT.  THERE
C  MAY BE MANY CALLS MADE TO INSIDE DURING EXECUTION BUT WILL ALWAYS
C  OCCUR BETWEEN CONTOUR COMPUTATIONS AND ONLY AFTER CONTOURS THAT HAVE
C  CLOSED (I.E. THE POINT IS THE SAME AS THE FIRST POINT).
C  THE THE INPUT DATA TO INSIDE COMES ENTIRELY FROM THE CALLING
C  ARGUMENTS.
C      THERE IS ONLY ONE EXIT RETURN FROM INSIDE AND IT IS USED UNDER
C      ALL CONDITIONS.
C      THE OUTPUT FROM INSIDE IS PASSED TO THE CALLING PROGRAM THROUGH
C  THE FUNCTION NAME.  IF THE POINT IS WITHIN THE DEFINED CONTOUR,
C  INSIDE IS SET TO LOGICAL TRUE.  IF THE POINT IS OUTSIDE THE CONTOUR,
C  INSIDE IS SET TO LOGICAL FALSE.
C      SIMPLY STATED, THE PROCESSING PERFORMED BY INSIDE CONSISTS OF

C  COMPUTING ALL OF THE Y-VALUES ON THE CONTOUR HAVING THE SAME X-VALUE
C  AS THE POINT QUESTION.  OF THE COMPUTED Y-VALUES, THOSE GREATER THAN
C  THE Y-COORDINATE OF THE POINT ARE COUNTED.  IF THE NUMBER OF VALUES
C  GREATER THAN THE Y-COORDINATE IS ODD, THE POINT IS CONTAINED WITHIN
C  THE CONTOUR.  IF THE NUMBER IS EVEN, THE POINT IS OUTSIDE OF THE
C  CONTOUR.
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Subroutine LOAD

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      SUBROUTINE LOAD(IG,MODIFY)                                        05-30-79
C     ******************************************************************
C     LOCAL VARIABLE DICTIONARY
C     ACTYP - TABLE OF AIRCRAFT TYPES
C     ANOISE - TABLE OF DNL NOISE CURVES
C     ARTHR - TABLE OF A/C THRUST SETTINGS
C     NOISE - TABLE OF NEL NOISE CURVES
C     CUTOFF -
C     DC - TABLE OF DISTANCE CRITERIA FOR NOISE CONTRIBUTION CUTOFF
C     DCTYPE - TABLE OF NAMES TO WHICH DC APPLY
C     IA - TABLE OF AIRCRAFT IDENTIFIED BY DIFFERENT A-WS THAN ETC
C     ICOM - DUMMY VAR FOR I/O
C     INDX1 - START ARG
C     INDX2 - START ARG
C     INDX3 - START ARG
C     INDX4 - START ARG
C     ITITL - ALPHANUMERIC OUTPUT TITLE
C     ITABS - TABLE OF LOOKUPS FOR REFERENCES TO OTHER A/C TABLES
C     MATCH -
C     NTOMAC -
C     NAC - NUMBER OF AIRCRAFT
C     NAMES - NAMES OF AIRCRAFT
C     NDAC - NUMBER OF (DISTINCTLY) DEFINED AIRCRAFT
C     NDA - NUMBER OF RECORDS IN CURRENT ARRAY READ IN
C     MAXAC,MAXNC,MAXTA,MAXPSF,MAXAPP - COUNT NUMBER OF VARIOUSLY       03-26-79
C                                       FORMATTED DATA                  03-26-79
C                   RECORDS TO BE READ IN
C     OP -
C     PSF - PERFORMANCE PROFILES
C     PWRS - AIRCRAFT THRUST SETTINGS
C
```

Subroutine MESAGE

```
      SUBROUTINE MESAGE (IGO,N,IND,IRET)
C
C     ******************************************************************
C
C      IGO - ERROR RETURN
C
C      IND - SET TO 999 IF IRET IS LESS THAN OR EQUALS ZERO
C      IRET - EXIT RETURN INDICATOR
C      MESAGE - SUBROUTINE
C      THE PURPOSE OF THE SUBROUTINE MESAGE IS TO OUTPUT INFORMATIVE
C  MESSAGES TO THE LINE PRINTER.
C      MESAGE DOES NOT USE ANY EXTERNAL SUBROUTINES.
C      THE SUBROUTINE MESAGE HAS ONLY ONE ENTRY POINT AND THE CALLING
C      SEQUENCE IS
C             CALL MESAGE (*,N,IND,IRET)
C  WHERE
C        *  MEMORY LOCATION IN CALLING PROGRAM FOR ALTERNATE RETURN.
C        N - MESSAGE NUMBER TO BE PRINTED.
C      IND - SET TO 999 IRET IS LESS THAN OR EQUAL TO ZERO.  OTHERWISE,
C            IND IS UNMODIFIED BY MESAGE.
C     IRET - INDICATOR DICTATING THE EXIT RETURN TO USE AND WHETHER OR
C            NOT TO MODIFY IND.
C            IRET > 0, NO MODIFICATION TO IND AND USE ALTERNATE RETURN.
C            IRET = 0, MODIFY IND AND USE NORMAL RETURN.
C            IRET < 0, MODIFY IND AND USE ALTERNATE RETURN.
C      MESAGE IS USED BY THE SUBROUTINES MERGRD, MIXRD, PROFRD, NOISRD,
C  SERRD, ACTDM, APPTRD, ALTPRD, READIN, SETRES, NEWMIX, WINDRD,
C  FSWRFD, RWYRD, AND TRAKRD.  THE SUBROUTINE MESAGE MAY BE CALLED MANY
C  TIMES DURING EXECUTION, BUT IT USUALLY USED TO OUTPUT MESSAGES
C  REGARDING ERROR CONDITIONS WHICH WILL ULTIMATELY CAUSE EXECUTION TO
C  BE TERMINATED.
C      THERE ARE THREE EXIT RETURNS FROM MESAGE LOCATED AT LINES
C  NUMBERED 88, 96 AND 97 OF THE SUBROUTINE LISTING IN SECTION 5.  THE
C  RETURN AT LINE 88 IS AN ALTERNATE RETURN USED WHEN IND IS NOT TO BE
C  TO BE MODIFIED.  THE RETURN AT LINE 96 IS AN ALTERNATE RETURN AND IS
C  MODIFIED.  THE RETURN AT LINE 97 IS A NORMAL RETURN AND IS USED
C  AFTER IND IS MODIFIED.
C      THE OUTPUT FROM MESAGE IS TO THE LINE PRINTER AND THE
C  MODIFICATION, IF INDICATED, OF THE CALLING VARIABLE IND.
C      NO PROCESSING IS PERFORMED BY MESAGE.
```

Subroutine METFIX

```
      SUBROUTINE METFIX (VEHCT,IGO)
C
C     ******************************************************************
C
C      LOCAL VARIABLE DICTIONARY
C
C      ALTFCT - CORRECTION FACTOR (SUBTRACT) FOR EVENT EXPOSURE, ALTERNATES
C      ALTWE - EVENING WEIGHTING FACTOR, ALTERNATE METRICS
C      ALTWN - NIGHT   WEIGHTING FACTOR, ALTERNATE METRICS
C     ICMT - USER COMMENT
C      IGO - ALTERNATE RETURN IN CALLING PROGRAM
```

```
C     ITMP - BLANK FILLED WORD
C     IXYZ - DUMMY VAR FOR IDENTIFICATION OF METRIC NAME TO 3 CHARACTERS
C     METID - LIST OF METRIC NAMES (LITERALS)
C     METTEV - THRESHOLD LEVEL FOR NOISE MEASURE
C     METLIT - DUMMY VAR FOR METRIC NAME
C      NEFCT - DUMMY VAR FOR METFIX
C      ALTNAM - NUMBERS OF ALTERNATE METRICS
C      NUMPR - NUMBER OF PRIMARY METRIC
C      PRMFCT - CORRECTION FACTOR (SUBTRACT) FOR EVENT EXPOSURE, PRIMARY
C      PRMWE - EVENING WEIGHTING FACTOR, PRIMARY METRIC
C      PRMWN - NIGHT   WEIGHTING FACTOR, PRIMARY METRIC
C     WGTFS - METRIC WEIGHTING FACTORS (ENERGY)
C      METFIX - SUBROUTINE
C INPUT DATA AND INITIALIZES A VARIETY OF VARIABLES AND INDICATORS FOR
C     THE METFIX SUBROUTINE READS THE METRIC SELECTION CARD FROM THE
C USE IN OTHER SUBROUTINES.
C     THE SUBROUTINE METFIX CALLS THE SUBROUTINE HEADER.
C     METFIX HAS ONLY ONE ENTRY POINT AND THE CALLING SEQUENCE IS
C                 CALL METFIX (NEFCT,*)
C WHERE
C     NEFCT - USED AS TEMPORARY STORAGE BY METFIX AND SET TO / BEFORE
C             RETURNING.
C     * - MEMORY LOCATION IN CALLING PROGRAM TO WHICH TO RETURN IF
C         ERRORS ARE ENCOUNTERED IN METFIX.
C     ONLY THE MAIN PROGRAM NOISE1 CALLS THE SUBROUTINE METFIX AT THE
C BEGINNING OF EACH RUN TO INITIALIZE THE VARIABLES ASSOCIATED WITH
C METRIC CHOICES AND CALCULATIONS AND TO INITIALIZE THE HEADER AND
C DATA LINE FORMATS FOR THE UPCOMING CONTOUR CALCULATIONS.
C     THE SUBROUTINE METFIX OBTAINS ALL OF ITS DATA FROM THE
C "METRIC CARD" IN THE INPUT DATA DECK.
C     THE SUBROUTINE METFIX HAS TWO EXIT RETURNS AT LINES NUMBERED 37
C AND 61 IN THE PROGRAM LISTING IN SECTION 5.  THE RETURN AT LINE 37
C IS ERROR RETURN IF THE FIVE CHARACTERS IN THE PRIMARY METRIC
C POSITION ARE INCORRECT AND HENCE, THE PRIMARY METRIC CANNOT BE
C DETERMINED.  THE RETURN AT LINE 61 IS USED OTHERWISE AND IS THE
C NORMAL RETURN.
C     THE OUTPUT DATA FROM METFIX CONSISTS OF INITIALIZING VARIABLES
C IN THE LABELED COMMON BLOCK /METRIC/.  THE FOLLOWING DESCRIBES THE
C VARIABLES:
C VARIABLE      DESCRIPTION
C PRMFCT        THE VALUE TO SUBTRACT FROM THE FINAL SUMMATION OF
C               SINGLE EVENT NOISE EXPOSURE AS FOLLOWS
C                 NEF - 88
C                 LDN - 49.4
C                 CNEL - 49.4
C                 LEQ - 89.4
C                 ASDS - 0
C                 DOSE - 0
C               THE VARIABLE APPLIES TO THE PRIMARY METRIC.


C ALTFCT        SAME AS PRMFCT EXCEPT FOR THE REQUESTED ALTERNATE
C               METRICS.
C PRMWP         EVENING WEIGHTING FACTOR FOR PRIMARY METRIC
C               (SEE BELOW)
C PRMWN         NIGHT WEIGHTING FACTOR FOR PRIMARY METRIC AS FOLLOWS
C               NEF     PRMWE = 1.0     PRMWN = 16.7
C               LDN           = 1.0           = 10.0
```

```
C                    CNEL          = 3.0             = 10.0
C                    LEQ           = 1.0             = 1.0
C                    ASDS          = 1.0      = 1.0
C                    DOSE          = 1.0             = 1.0
C  ALTWE             SAME AS ABOVE EXCEPT FOR SELECTED
C  ALTWN             ALTERNATE METRICS.
C  NUMPR             NUMBER OF PRIMARY METRIC
C                    SEF = 1          LEQ = 4
C                    IDN = 2          ASDS = 5
C                    CNEL = 3         DOSE = 6
C  NUMALT            NUMBERS FOR ALTERNATE METRICS AS ABOVE.
C
```

Subroutine MIXRD

```
      SUBROUTINE MIXRD (I[illegible]1,FAC,IDUMP)
C
C     ****************************************************************
C
C      LOCAL VARIABLE DICTIONARY
C
C     [illegible] - TOTAL EQUIVALENT DAYTIME OPERATIONS
C     [illegible] - BUFFER, CARD INPUT, LANDINGS
C     CAC - COMBINED AIRCRAFT/TRACK
C     [illegible] - BUFFER, CARD INPUT, TAKEOFFS
C      [illegible] - DUMMY ARG USED TO CLEAR CONTENTS OF COMMON BLOCK RWYJTL
C      [illegible] - ANOTHER DUMMY ARG
C     [illegible] - EQUIVALENT DAYTIME OPERATIONS FOR
C     SELECTED PROFILE
C     [illegible] - EQUIVALENT DAYTIME OPERATIONS, ALL PROFILES
C      FAC - INCOMING MIX DATA ACTION INDICATOR (SEE BELOW)
C      [illegible] - BLANK FILLED WORD (DOUBLE PREC)
C     [illegible] - [illegible]
C     [illegible] - ERROR FLAG )[illegible] PROFILE(
C     [illegible] - ERROR FLAG ) (
C      [illegible] - [illegible] FOR CURRENT TRACK
C      IDUMP - PRINT CONTROL VARIABLE (SEE BELOW)
C      [illegible] - ERROR RETURN
C      [illegible] - ALTERNATE RETURN
C      IRBIG - NUMBER OF BIGGEST RUNWAY
C      [illegible]C - FLAG, DISTINGUISHES BETWEEN CALLS BY [illegible] AND [illegible]
C      IT[illegible] - TRACK GROUP NUMBER
C      I[illegible]C - NOISE CURVE NUMBER ASSIGNED TO CURRENT A/C
C      I[illegible]FAC - FLIGHT DEFINITION TABLE
C      ITR - TABLE OF TRACK NUMBERS ASSIGNED TO EACH RUNWAY
C      [illegible] - TABLE OF TRACK GROUP NUMBERS
C      ITRK - TRACK NUMBER
C      IV - ASSIGNED VARIABLE NAME
C      IVX  - ASSIGNED VARIABLE NAME
C      IVXX - ASSIGNED VARIABLE NAME
C       ITRK - SECONDARY TRACK NUMBER
C     K - NUMBER OF FLIGHTS TOTALED
C      MASK - DECODES I[illegible]FAC
C      MASK[illegible] - MORE BINARY DECODING
C     M[illegible] - SMALLEST PROFILE NUMBER
C     MP - PROFILE NUMBER
C      NTRK - ANOTHER TRACK NUMBER
C      N[illegible]PR - PROFILE NUMBER
C     OPS - TOTAL OPERATIONS
```

```
C     NFP  - TOTAL ARRIVALS/CRACK )MODIFY(
C      PROF - A/C PERFORMANCE PROFILES
C      BASE OPERATIONS BROKEN DOWN BY RUNWAY
C     STOT - TOTAL LANDINGS
C     STNT - TOTAL TAKEOFFS
C     TMJS - TOTAL OPERATIONS MAJOR USERS
C     TOPS - TOTAL OPERATIONS
C     TFPR - TOTAL DEPARTURES/CRACK )MODIFY(
C      MIXRD - SUBROUTINE
C      THE PURPOSE OF SUBROUTINE MIXRD IS TO READ DIRECTLY ASSIGNED
C AIRCRAFT OPERATIONAL INPUT DATA.  APPROPRIATE VARIABLES DESCRIBING
C THE OPERATIONAL CHARACTERISTICS OF THE FLIGHTS ALONG WITH THE
C NUMBER OF OPERATIONS ARE CONSTRUCTED.
C     MIXRD USES THE SUBROUTINES CDATAI, DMPTAI, EQUOPS, NEWRED, SORT4
C AND MESAGE.
C     THERE ARE FOUR ENTRY POINTS TO MIXRD AND CALLING SEQUENCE FOR

C ONE FIRST ONE IS
C                  CALL MIXRD (*, FAC, IDUMP)
C WHERE
C       * - RETURN LOCATION IN CALLING PROGRAM TO WHICH TO RETURN IF
C           ERRORS ARE ENCOUNTERED IN MIXRD.
C       FAC - AN INDICATOR TELLING WHAT TO DO WITH THE INCOMING MIX
C             DATA.
C             IF FAC = 0, NEW MIX DATA IS COMING IN AND ANY OLD MIX
C             DATA IS DISCARDED.  IF FAC > 0, THE NEW MIX DATA
C             OPERATIONS ARE MULTIPLIED BY FAC AND REPLACE THE OLD MIX
C             DATA.  IF FAC < 0, THE NEW MIX DATA IS MULTIPLIED BY /FAC/
C             AND ADDED TO THE OLD MIX DATA.
C     IDUMP - PRINT CONTROL VARIABLE.  IF IDUMP = 0,, RAW DAT WILL BE
C             PRINTED AMONG OTHER OUTPUT.  IF IDUMP = 0, THE RAW DATA
C             FROM THE INPUT CARDS WILL NOT BE PRINTED.  IF IDUMP / 0
C             AND IDUMP / 0, A DETAILED DUMP OF THE FLIGHT DEFINITION
C             TABLE IFTBAC AND THE OPERATIONS TABLE IOPS WILL BE PRINTED
C             FOR ALL DEFINED FLIGHTS IN ADDITION TO THE NORMAL OUTPUT.
C     THE SUBROUTINE MIXRD IS CALLED ONLY BY THE SUBROUTINE READIN.
C IT IS CALLED WHEN NUMBER ASSIGNED AIRCRAFT OPERATIONS DATA ARE
C     INPUT.  IT MAY BE CALLED MANY TIMES.
C     IN ADDITION TO THE CALLING VARIABLE FAC, THE INPUT DATA FOR
C MIXRD IS READ FROM CARDS IN THE INPUT DATA DECK.
C     THERE ARE THREE ERROR RETURNS FROM MIXRD AT LINES NUMBERED 74,
C 753, AND 787 IN THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT
C LINE 74 IS AN ERROR RETURN AND IS USED ONLY IF THE NUMBER OF DEFINED
C FLIGHTS EXCEEDS 2110, THE PRESENT TABLE STORAGE SIZE.  THE USE OF
C THIS RETURN WILL CAUSE EXECUTION TO BE TERMINATED.  THE RETURN AT
C LINE 787 IS USED AS AN ERROR RETURN RESULTING IN EXECUTION TERMINATION
C AND IS USED IF ANY ERRORS ARE DETECTED IN THE INPUT DATA.  THE
C RETURN AT LINE 753 IS A NORMAL RETURN AND IS USED IF NO ERRORS ARE
C DETECTED IN THE INPUT DATA.
C     THE OUTPUT FROM MIXRD CONSISTS OF INFORMATION PRINTED ON THE
C LINE PRINTER AND DATA RIGHT INTERNALIZATIONS.  MIXRD CALLS NEWRED
C WHICH PRINTS THE RAW INPUT MIX DATA FROM THE AOT DECK AND DMPTAI
C WHICH PRINTS THE IFTBAC OPERATIONS AND PRIMARY UTILIZATION TABLES
C IN THE DEFAULT.  IN ADDITION, MIXRD WILL OUTPUT THE CONTENTS OF THE
C FLIGHT IDENTIFICATION TABLE IOPAC AND THE NUMBER OF OPERATIONS
C TABLE IOPS FOR EACH DEFINED FLIGHT IF REQUESTED TO DO SO BY THE
C USER.  THESE ARE BE LOCATED IN THE LABELED COMMON BLOCK
C /PRIVIX/.
C     INTERNAL VARIABLES IN THE LABELED COMMON BLOCK /PRAFIX/ ARE
C INITIALIZED BY MIXRD.  THE VARIABLE NAMES AND THEIR DESCRIPTIONS
C FOLLOW
```

```
C      VARIABLE    DESCRIPTION
C      NTRF        TOTAL NUMBER OF DISTINCTLY DEFINED FLIGHTS
C     ITPRAC       A TABLE CONTAINING UP TO 2000 DISTINCT FLIGHT
C                  IDENTIFICATION CODES.  THE CONTENTS OF EACH WORD IN
C                  THE TABLE ARE AS FOLLOWS, WHERE BINARY BIT POSITION
C                  0 IS THE LEAST SIGNIFICANT BIT.
C                     BIT
C                  POSITIONS            CONTENTS
C                  0-7                  NOISE CURVE SET NUMBER MINUS 1
C                  8-12                 PERFORMANCE PROFILE NUMBER
C                  13-19                GROUND TRACK NUMBER
C                  20-24                TRACK GROUP NUMBER
C      NOPS    THE ASSIGNED NUMBER OF OPERATIONS FOR EACH OF THE DEFINED
C              FLIGHTS IN ITPRAC AND FOR ALL POSSIBLE METRICS.  WHERE K
C              IS THE FLIGHT NUMBER, THE OPERATIONS/METRIC
C              CORRESPONDENCE IS AS FOLLOWS
C              NOPS (K,1) - NOISE
C              NOPS (K,2) - NOX
C              NOPS (K,3) - CNEL
C              NOPS (K,4) - LEQ, ASDS, DOSE
C  IT SHOULD BE NOTED THAT THE WORDS CONTAINED IN THE TABLE ITPRAC
C  ARE ACTUALLY CONSTRUCTED IN SUBROUTINE NEWRED, THEY ARE STORED
C  THE TABLE BY SUBROUTINE MIXRD.
C      THE PROCESSING PERFORMED BY MIXRD CONSISTS OF SORTING THE FLIGHT
C  DEFINITION TABLE ITPRAC AND THE OPERATIONS TABLE NOPS ONCE ALL OF
C  THE FLIGHTS HAVE BEEN DEFINED.  THE WORDS IN THE TABLE ITPRAC, EACH
C  ASSUMED TO BE A SINGLE INTEGER VALUE, ARE SORTED IN DESCENDING ORDER
C  WHILE THE VALUES IN THE TABLE NOPS ARE SORTED SO THAT THE NUMBER OF
C  OPERATIONS FOR A FLIGHT IS IN THE SAME RELATIVE POSITION IN NOPS AS
C  THE FLIGHT IDENTIFICATION WORD IN ITPRAC.
C      THE SECOND ENTRY IN MIXRD IS AT PCNTRD AND THE CALLING SEQUENCE
C  IS
C                    CALL PCNTRD (*  FAC, IDUMP)
C  WHERE THE CALLING ARGUMENTS ARE AS PREVIOUSLY DEFINED IN THE MIXRD
C  ENTRY.
C      THE SUBROUTINES CALLED BY PCNTRD ARE ZERO, NBETW, MESAGE, AND,
C  BY DEFAULT, NEWMIX.  THE SUBROUTINE NEWMIX IS NOT ACTUALLY CALLED
C  BUT IS ENTERED AS A NORMAL CONTINUATION OF PCNTRD AT THE NEWMIX
C  ENTRY POINT.
C      READIN IS THE ONLY SUBROUTINE TO USE PCNTRD AND IT MAY BE CALLED
C  SEVERAL TIMES DURING THE INPUT PHASE OF EXECUTION.
C      THE INPUT TO PCNTRD IS PROVIDED FROM CARDS IN THE INPUT DATA
C  DECK.
C      THE ONLY EXIT FROM THE PCNTRD ENTRY IS DIRECTLY INTO THE NEWMIX
C  ENTRY.  THE EXIT RETURNS WILL BE EXECUTED FROM NEWMIX.
C      PCNTRD INITIALIZES THE TRACK TAKEOFF AND LANDING UTILIZATION
C  TABLES TOFF AND TRRL RESPECTIVELY AND COMPUTES AND PRINTS THE SUM OF
C  THE UTILIZATION FOR THE ENTIRE SET OF TRACKS.  THIS IS A DIAGNOSTIC
C  OUTPUT WHICH IS USEFUL WHEN CHECKING THE INPUT DATA.
C      THE THIRD ENTRY IN MIXRD IS AT NEWMIX AND THE CALLING SEQUENCE
C  IS
C                    CALL NEWMIX (*, FAC, IDUMP)
C  WHERE THE CALLING ARGUMENTS ARE AS PREVIOUSLY DEFINED IN MIXRD.
C      NEWMIX USES THE EXTERNAL SUBROUTINES SORTA, MESAGE, EQUOPS,
C  IMPRAI, CURTAL, AND NUMRED.
C      NEWMIX IS CALLED BY SUBROUTINE READIN AND IS A NORMAL
C  CONTINUATION FOR THE ENTRY AT PCNTRD AS DISCUSSED JUST PREVIOUSLY.
C      NEWMIX READS AIRCRAFT OPERATIONS DATA FROM THE INPUT DECK,
C  THROUGH THE SUBROUTINE NEWRED, JUST AS IN MIXRD BUT, UNLIKE MIXRD,
```

```
C  ASSIGNS THE OPERATIONS TO THE FLIGHT TRACKS IN THE PROPORTIONS
C  INDICATED IN THE TRACK TAKEOFF AND LANDING UTILIZATION TABLES TPER
C  AND PER, RESPECTIVELY.  IN ADDITION, AND AGAIN UNLIKE MIXRD, THE
C  LANDING PERFORMANCE PROFILE NUMBER WILL BE COMPUTED BY NEWMIX, IF
C  NECESSARY, AND ENTERED INTO THE FLIGHT IDENTIFICATION STORED IN THE
C  TABLE ITPRAC.
C      OTHERWISE, NEWMIX PERFORMS THE SAME FUNCTION, HAS THE SAME EXIT
C  RETURNS WHICH MAY BE USED FOR THE SAME REASONS AND PERFORMS THE
C  SAME VARIABLE INITIALIZATIONS AS THE ENTRY AT MIXRD.
C      THE FIRST ENTRY IN MIXRD IS AT MERGRD AND THE CALLING SEQUENCE
C  IS
C                  CALL MERGRD (*, IDUMP)
C  WHERE THE CALL ARGUMENTS ARE AS DEFINED IN THE MIXRD CALLING
C  SEQUENCE.
C      MERGRD CALLS THE SUBROUTINES NBETW, MESAGE, AND SORTH.
C      READIN IS THE ONLY USER OF MERGRD AND MAY CALL IT SEVERAL TIMES.
C      MERGRD RECEIVES ITS INPUT DATA FROM THE DATA CARDS IN THE INPUT




C  DECK AND USING THAT WILL PERFORM OPERATIONS ON THE TABLES ITPRAC
C  AND NOPS.
C      THERE ARE TWO EXIT RETURNS FROM MERGRD LOCATED AT LINES 254 AND
C  265 OF THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT LINE 264
C  IS AN ERROR RETURN WHILE THE ONE AT LINE 265 IS THE NORMAL RETURN.
C      THE PURPOSE OF MERGRD IS TO CHANGE THE NOISE CURVE SET NUMBER IN
C  THE CONTENTS OF THE TABLE ITPRAC TO A DIFFERENT NUMBER IF IT IS
C  DESIRED TO DO SO GIVEN NUMBER WHERE BOTH VALUES ARE READ FROM A
C  DATA CARD.  THE RESULTANT FLIGHT IDENTIFICATION AND OPERATIONS FOR
C  EACH FLIGHT ARE THEN COMBINED (OR MERGED) WITH ANY OTHER FLIGHTS
C  WITH THE SAME IDENTIFICATION CODE SO THAT WHEN MERGRD IS DONE NO TWO
C  FLIGHT IDENTIFICATION CODES IN THE TABLES ITPRAC ARE THE SAME.
C
```

Function NBETW

```
      LOGICAL FUNCTION NBETW (I,J,K)

C
C     ******************************************************************

C     I - ARRAY OF TEST VALUES

C     J - LOWER BOUND
C     K - UPPER BOUND
C      NBETW - TRUE OR FALSE
C
C THIS FUNCTION IS .TRUE. IF A IS NOT BETWEEN B AND C INCLUSIVE.
C
C  2.25       NBETW - LOGICAL FUNCTION SUBROUTINE
C             NBETW DETERMINES LOGICALLY (I.E., TRUE OR FALSE) IF A
C GIVEN NUMBER IS NOT BETWEEN TWO OTHER GIVEN NUMBERS.
C             NBETW DOES NOT USE ANY EXTERNAL SUBROUTINES.
C             THERE IS ONLY ONE ENTRY TO NBETW AND THE CALLING SEQUENCE
C  IS
C                  NBETW (I,J,K)
```

```
WHERE
                I - THE INTEGER VALUE IN QUESTION
                J - THE INTEGER LOWER BOUND
                K - THE INTEGER UPPER BOUND
              NBETW IS CALLED BY THE SUBROUTINES MEPGRD, PROFRD,
"OISRD, GRPRD, ACTRDT, ALTRRD, PCNTRD, NEWRED, TRAKRD, RWYRD AND
"INDRD.
     THE INPUT TO NBETW IS ENTIRELY THROUGH THE CALLING ARGUMENTS.
     THERE IS ONLY ONE EXIT RETURN FROM NBETW AND IT IS USED UNDER
     ALL CONDITIONS.
     THE OUTPUT OF NBETW IS RETURNED TO THE CALLING PROGRAM THROUGH
THE FUNCTION NAME AND CONSISTS OF A LOGICAL VALUE TRUE OR FALSE.
     THE PROCESSING PERFORMED BY NBETW CAN BE FORMULATED AS FOLLOWS
       NBETW = FALSE , IF J < I< K
      OR
       NBETW = TRUE , OTHERWISE
WHERE I,J,K ARE THE CALLING ARGUMENTS.
```

Subroutine NEWPNT

```
      SUBROUTINE NEWPNT (IGO,NPTS)

C
C     ******************************************************************
C
C     LOCAL VARIABLE DICTIONARY
C
C     AINC - CONTOUR POINT SEARCH ANGULAR STEP
C     ANGLE - ANGULAR DISPLACEMENT OF TEST POINT FROM PREVIOUS POINT
C     D - STEP SIZE BETWEEN CONTOUR POINTS
C     DCHK - STEP SIZE TOLERANCE FOR LINEAR SEARCH
C     DD - LINEAR SEARCH STEP SIZE
C                (DISTANCE CONTOUR POINT BETWEEN 2 TEST POINTS)
C     DELC - MAXIMUM ALLOWABLE DISTANCE BETWEEN CONTOUR POINTS (FEET)
C     DPIM - CONTOUR SEGMENT PARALLELISM TOLERANCE
C     E - TEST EXPOSURE AT POINT BY
C     GRADV - LAST COMPUTED GRADIENT VECTOR COMPONENTS
C     IGO - ERROR RETURN
C     IJK - LOOP COUNTER
C     KK - MULTIPLYING FACTOR FOR ITERATION LIMITS
C     M - ITERATION LIMI TIMES MULTIPLYING FACTOR
C     "BY" - NOISE VALUE AT POSITION OF NEXT CONTOUR POINT
C     "OYC - TEST EXPOSURE AT P)
C     "OYS - TEST EXPOSURES AT POINTS PO IN CURRENT SEARCH
C     "OY7 - TEST EXPOSURE AT PO (BRANCHING PROBLEM IS BYASED FOR THESE)
C     NPTS - NUMBER OF POINTS IN CONTOUR
C     "SCRCH - MAPS OF ITERATION LIMITS
C     "YS - NUMBER OF TIMES EXPOSE HAS BEEN CALLED
C     "PTS - NUMBER OF SEGMENTS IN CONTOUR
C     SARGA - POINT SEARCH ANGLE STEP (RADIANS)
C     PD - DOT PRODUCT TO CHECK PARALLELISM OF CONTOUR SEGMENTS
C     PMAG - VECTOR MAGNITUDE OF PP
C     PPP - DIFFERENCES BETWEEN X,Y COORDS OF ADJACENT CONTOUR POINTS
C     PZ - PERPENDICULAR VECTOR
C     Q - QUOTIENT OF EXPOSURE DIFFERENCES
C     PO - FIRST GUESS AT LOCATION OF NEXT POINT, CONTAINS NEXT POINT ON RETURN
C     "P" - SCRATCH COPY OF NEXT CONTOUR POINT LOCATION
```

```
C      DP - AS PRR,SIGN OF X COORD REVERSED, COORD ORDER Y,X,Z
C      PPTS - X,Y COORDINATES OF TEST POINTS IN CURRENT SEARCH
C      PO - COORDINATES OF TEST CONTOUR POINT (OFFSET FROM XX,YY
C                ACCORDING TO ANGLE,D)
C      RR - DIFFERENCE BETWEEN X,Y COORDS OF NEW POINT AND ARBITRARY EXISTING
C                CONTOUR POINT
C      SXK - WORKING COPY OF NEXT CONTOUR POINT (TENTATIVE)
C      SY - DIFFERENCE VECTOR BETWEEN STARTING AND TEST POINTS
C      TOT - CONTOUR ERROR TOLERANCE (SACROSANCT)
C      TOL - CONTOUR ERROR TOLERANCE (CLOBBERED BY NEWPNT)
C      TOLER - ERROR TOLERANCE
C      VAL - CONTOUR VALUE (LEVEL)
C      VAL1 - EXPOSURE AT PREVIOUS CONTOUR POINT
C      VAL2 - TEST EXPOSURE AT PXY
C      W - SIGN OF EXPOSURE DIFFERENCES
C      X - PREVIOUSLY COMPUTED COORDINATES
C      X0 - COORDINATE OF P0
C      XVAL - TEST EXPOSURE
C      XX - ALIAS P0(1)
C      XZ - ALIAS P0(1)
C      XZ0 - DIFFERENCE VECTOR BETWEEN P0 AND PZ
C      Y - PREVIOUSLY COMPUTED COORDINATES
C      Y0 - COORDINATE OF P0
C      YZ - ALIAS P0(2)
C      Z - DIFFERENCE BETWEEN PRIOR AND TEST POINT EXPOSURES
C      NEWPNT - SUBROUTINE
C      THE PURPOSE OF SUBROUTINE NEWPNT IS TO FIND SUBSEQUENT POINTS ON
C CONTOUR ONCE THE FIRST POINT HAS BEEN FOUND.  THIS SUBROUTINE IS
C USED FOR MSE, TDM, CMST, AND TEQ CONTOURS.
C      NEWPNT CALLS THE SUBROUTINES SGNP, VTRN, VSUB, VUNT, VMAG,
C VSCL, DSPLD, AND EXPOSE.
C      THE SUBROUTINE NEWPNT HAS ONE ENTRY POINT AND THE FOLLOWING IS
C THE CALLING SEQUENCE:
C                CALL NEWPNT (*, NPTS)
C WHERE
C        * - MEMORY LOCATION IN CALLING PROGRAM FOR ERROR RETURN.
C     NPTS - THE NUMBER OF CONTOUR POINTS THAT HAVE ALREADY BEEN
C            COMPUTED.
C      THE MAIN PROGRAM NOISE1 IS THE ONLY USER OF SUBROUTINE NEWPNT
C      THE MAIN PROGRAM NOISE1 IS THE ONLY USER OF SUBROUTINE NEWPNT
C AND WILL CALL IT MANY TIMES DURING EXECUTION TO FIND CONTOUR POINTS
C ON MSE, TDM, CMST, OR TEQ CONTOURS.  IF DSDS OR DOSE CONTOURS ARE
C BEING COMPUTED, THE SUBROUTINE NEWPNT WILL NOT BE USED AT ALL.
C      OTHER THAN THE NUMBER OF POINTS (NPTS) IN THE CALLING
C ARGUMENTS, THE INPUT TO SUBROUTINE NEWPNT IS PROVIDED BY VARIABLES
C IN LABELED COMMON BLOCKS.  THE FOLLOWING DESCRIBES THAT DATA.
C      COMMON
C        BLOCK      VARIABLE  DESCRIPTION
C        /SK/       TOL2      CONTOUR ERROR TOLERANCE (NEVER CHANGED).
C                   TOL       CONTOUR ERROR TOLERANCE (SOMETIMES CHANGED
C                             BY NEWPNT).
C                   VAL       CONTOUR VALUE (LEVEL).
C     /TCOPS/       P0        FIRST GUESS AT POSITION OF NEXT POINT.
C                             WILL CONTAIN NEW POINT ON NORMAL RETURN.
C    /SCRACH/       X, Y      PREVIOUSLY COMPUTED COORDINATES.
C      COMMON
C        BLOCK      VARIABLE  DESCRIPTION
C      /PLOTP/      DELS      MAXIMUM ALLOWABLE DISTANCE BETWEEN
C                             CONTOUR POINTS (FEET).
C      /GRADNT/     GRADT     LAST COMPUTED UNIT GRADIENT VECTOR
C                             COMPONENTS.
```

```
C     THERE ARE SEVEN EXIT RETURNS FROM THE SUBROUTINE NEWPNT
C  LOCATED AT LINES NUMBERED 58, 74, 89, 129, 134, 153, AND 217 IN THE
C  SUBROUTINE LISTING IN SECTION 5.  THE RETURN AR LINE 58 IS USED IF
C  THE SEARCH PATTERN COMPLETELY FAILS TO FIND THE CONTOUR.  IT IS AN
C  ERROR RETURN OMITTING FURTHER COMPUTATIONS ON THE CURRENT CONTOUR.
C  THE RETURN AT LINE 74 IS ALSO AN ERROR RETURN HAVING THE SAME
C  CONSEQUENCE AND IS USED IF THE NUMBER OF TRIAL POINTS HAS BECOME
C  EXCESSIVE.  THE RETURN AT LINE 89 IS, LIKEWISE, AN ERROR RETURN
C  USED WHEN THE NUMBER OF INTERPOLATION TRIALS BETWEEN TWO POINTS
C  BECOMES EXCESSIVE DUE TO A DISCONTINUITY IN THE NOISE FUNCTION.  THE
C  RETURN AT LINE 129 IS AN ERROR RETURN USED IF, IN GENERAL, THE
C  NUMBER OF TRIES AT FINDING A NEW POINT IS EXCESSIVE.  THE RETURN AT
C  LINE 134 IS A NORMAL RETURN AND IS USED IF A POINT ON THE CONTOUR
C  HAS BEEN FOUND AND THE NUMBER OF PREVIOUSLY COMPUTED POINTS IS LESS
C  THAN SIX.  THE RETURN AT LINE 153 IS THE ONLY OTHER NORMAL RETURN
C  AND IS USED WHEN A POINT ON THE CONTOUR HAS BEEN FOUND AND HAS
C  PASSED THE LOOP CHECK SEQUENCE.  THE RETURN AT LINE 217 IS AN ERROR
C  RETURN AND IS USED WHEN THE PROGRAM FINDS ITSELF IN A LOOP AND
C  CANNOT FIND ITS WAY OUT.
C     THE OUTPUT OF SUBROUTINE NEWPNT IS SIMPLY THE POSITION OF THE
C  NEXT CONTOUR POINT WHICH IS PASSED TO THE CALLING PROGRAM THROUGH
C  THE VARIABLE RC IN THE LABELED COMMON BLOCK /LOOPS/ AND THE NOISE
C  VALUE AT THAT POINT WHICH IS PASSED THROUGH THE REAL VARIABLE NEW1
C  IN THE LABELED COMMON BLOCK /SCRTCH/.
C
C     THE PROCESSING PERFORMED BY SUBROUTINE NEWPNT IS DESCRIBED IN
C  THE FOLLOWING PARAGRAPHS.
C
C     ONCE AT LEAST ONE POINT ON THE CONTOUR IS AVAILABLE, THE FIRST
C  STEP IS TO DETERMINE THE NOISE GRADIENT AT THE LAST POINT KNOWN TO
C  BE GOOD.  THE INITIAL STEP IS THEN MADE IN A DIRECTION
C  PERPENDICULAR TO THE GRADIENT AND AT A DISTANCE (THE "STEPSIZE")
C  WHICH HAS BEEN SPECIFIED AS AN INPUT (SEE FIGURE).  IF THIS FIRST
C  STEP IS NOT ON THE CONTOUR, SUBSEQUENT GUESSES ARE MADE BY ROTATING
C  AROUND THE LAST GOOD POINT.  THIS ROTATION IS DONE IN TWO STEPS OF
C  30 , IN A DIRECTION THAT, ACCORDING TO THE GRADIENT, SHOULD CAUSE
C  THE NOISE EXPOSURE TO APPROACH THE CONTOUR VALUE.  IF THIS FAILS,
C  THE STEPSIZE IS HALVED, THE ANGLE STEP INCREASED TO 90 , AND THE
C  ROTATION PERFORMED.  IF THE SECOND ROTATION FAILS, THE STEPSIZE IS
C  HALVED AGAIN, AND THE POINT ROTATED IN 12 STEPS.  IF THE CONTOUR POINT HAS STILL NOT BEEN
C  FOUND, STEP HALVED AGAIN".  IF THIS FAILS, THE CONTOUR IS DELETED.
C  WHILE THE ABOVE SEARCH IS BEING PERFORMED, A CHECK IS MADE FOR
C  CROSSING THE CONTOUR.  IF IT IS CROSSED, THE CONTOUR POINT IS THEN
C  FOUND BY REPEATED LINEAR INTERPOLATION.  AFTER A POTENTIAL POINT HAS
C  BEEN FOUND, CHECKS ARE MADE TO VERIFY THAT THIS POINT IS NOT ACROSS
C  A RIVER OR INLET OF THE CONTOUR FROM THE LAST CONTOUR POINT.  IF IT
C  IS, THE STEPSIZE IS HALVED AND THE SEARCH PROCEDURE IS REPEATED.
C  THIS INSURES A FAITHFUL TRACKING OF THE ACTUAL CONTOUR.
C     UNDER CERTAIN CIRCUMSTANCES, IT IS POSSIBLE FOR THE CONTOUR
C  SEARCH PROGRAM TO BECOME CAUGHT IN A LOOP IN A DISTANT PART OF THE
C  CONTOUR AND NEVER RETURN TO THE START POINT (SEE FIGURE FOLLOWING
C  FOR AN EXAMPLE OF SUCH A SITUATION).  A LOOPING SITUATION IS DETECED
C  BY COMPARING A POTENTIAL NEW CONTOUR POINT WITH PAIRS OF POINTS
C  ALREADY DETERMINED TO BE ON THE CONTOUR.  IF THE NEW POINT IS WITHIN
C  ONE-TENTH OF THE INPUT STEPSIZE OF A STRAIGHT LINE JOINING A PAIR
C  OF CONSECUTIVE CONTOUR POINTS, THEN THE PROGRAM IS LOOPING.  TO
C  CORRECT THE SITUATION, THE PROGRAM RETURNS TO THE LAST GOOD CONTOUR
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C  DATA AND COMPUTES THE NOISE EXPOSURE AT A FULL CIRCLE OF 24 POINTS.
C  THE RADIUS OF THE CIRCLE IS 1.5 TIMES THE CURRENTLY UPDATED
C  STEPSIZE.  THE SEARCH IS BEGUN WITH THE POINT IN THE SAME DIRECTION
C  AS THE PREVIOUS CONTOUR POINT (SEE FOLLOWING FIGURE).  AFTER ALL
C  POINTS ON THE CIRCLE HAVE BEEN COMPUTED, THEY ARE EXAMINED TO
C  DETERMINE ALL PLACES WHERE THE CONTOUR CROSSES THE CIRCLE OF POINTS.
C  ANY SUCH CONTOUR CROSSING ARE THEN EXAMINED IN REVERSE ORDER TO
C  DETERMINE IF THEY ARE ON A PREVIOUSLY-FOUND PORTION OF THE CONTOUR.
C  THE FIRST NEW CONTOUR POINT FOUND IS CHOSEN AS THE NEXT CONTOUR
C  POINT.  IF NO POINT IS FOUND AND IF THE RADIUS OF THE CIRCLE IS LESS
C  THAN THE INPUT STEP SIZE, THE SEARCH IS REPEATED WITH A RADIUS EQUAL
C  TO THE INPUT STEP SIZE.  IF A NEW POINT IS STILL CANNOT BE FOUND,
C  THE RUN IS ABORTED.
C      THE FOLLOWING PARAGRAPHS WILL DELINEATE THE SECTIONS OF THE
C  SUBROUTINE NEWPNT THAT PERFORM THE PROCESSES JUST DESCRIBED (REFER
C  TO THE SUBROUTINE LISTING IN SECTION 5).
C      LINE 17  THE NOISE EXPOSURE VALUE AT RO IS COMPUTED (SIGNIFANT
C               FLIGHTS ONLY).
C      LINES 29 TO 58  THE NORMAL SEARCH PATTERN IS EXECUTED (SEE
C                      PREVIOUS FIGURE).
C      LINES 62 TO 77 CHECKS ARE MADE TO SEE IF A POTENTIAL CONTOUR
C                     POINT IS ACROSS A FINGER OR INLET IN THE CONTOUR.
C      LINES 81 TO 102 REPEATED INTERPOLATIONS BETWEEN TWO POINTS
C                      WHICH STRADDLE THE CONTOUR.

C      LINES 105 TO 130 ADDITIONAL FINGER AND INLET CROSSING CHECKS AND
C                       TOLERANCE CHECKS USING ALL DEFINED FLIGHTS AT A
C                       POTENTIAL CONTOUR POINT.
C                       POTENTIAL CONTOUR POINT.
C      LINES 134 TO 173 CHECK POTENTIAL CONTOUR POINT FOR LOOPING
C                       CONDITIONS.  THE PROCEDURE USED IS NEARLY
C                       IDENTICAL TO THE METHOD DESCRIBED IN SUBROUTINE
C                       CKLOOP.
C      LINES 179 TO 217  ALTERED SEARCH PATTERN EXECUTED AFTER
C                        DETERMINING EXISTENCE OF LOOPING CONDITIONS
C                        (SEE FIGURE).
C      LINES 219 TO 237  DISPOSITION OF POTENTIAL CONTOUR POINT FOUND
C                        BY ALTERED SEARCH PATTERN.
C
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Subroutine NEWRED

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      SUBROUTINE NEWRED (I301,I302,NCC,IV,CPS,FAC,IOC,IDUMP,WE,WN,
     1IIIIIOI")

C     ***************************************************************
C     READ NIX DATA
C     TOT - TOTAL COMBINED OPERATIONS )EVERYTHING(
C     TOTC - TOTAL NUMBER OF RESTRICTED OPERATIONS )DAY/ EVE/ NIGHT(
C     TOTTO - TOTAL NUMBER OF RESTRICTED TAKEOFFS
C     TOTLD - TOTAL NUMBER OF RESTRICTED LANDINGS
C     NUMSTG - RUNWAY ARRAY, NUMBER OF OPERATIONS
C     IRWY - LOOKUP ARG> _DEPARTURE_ RWY TO _ARRIVAL_ RWY NUMBERS
C     IV - TRACK GROUP NUMBER < 32*PROFILE NUMBER
C     CPS - NUMBER OF OPERATIONS
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C     EQOPS - EQUIVALENT DAYTIME OPERATIONS
C     DUM - LABEL ARRAY )DAY,EVENING,NIGHT(
C     NAM - AIRCRAFT NAME
C     NPROPS - NUMBER OF PROFILES
C     NDAC - NUMBER OF AIRCRAFT )DEFAULT(
C     NAC - NUMBER OF DEFINED AIRCRAFT)LOOP COUNTER(
C     NAAC -
C     ITAC - AIRCRAFT TYPE
C     ITRK - TRACK NUMBER
C     KPRF - PROFILE I.D. (ORDINAL)                                  03-29-79
C     IPRF - PROFILE NUMBER
C     IND - ERROR FLAG,ARRAY SUBSCRIPTS BOUNDS
C     NCC - NOISE CURVE NUMBER
C     ITG - TRACK GROUP NUMBER
C     FAC - FUDGES AIRCRAFT NUMBER OF OPERATIONS
C     T - SUBTOTAL OPERATIONS
C     IP - RUNWAY NUMBER
C     NP - PROFILE NUMBER
C     YTOT - TOTAL ANNUAL OPERATIONS
C      NEWRED - SUBROUTINE
C      THE SUBROUTINE NEWRED READS THE AIRCRAFT OPERATIONS DATA FROM
C THE INPUT DATA.  IT ASSOCIATES THE AIRCRAFT NUMBER WITH THE NOISE
C CURVE NUMBER AND FLIGHT PERFORMANCE DATA WITH STAGE LENGHT
C INFORMATION.  NEWRED HAS ALTERNATE ENTRY POINTS AT EQNOPS, CLRTAL,
C PRTTAL, AND ACUPDT.
C     NEWRED USES THE SUBROUTINES MESAGE AND FBETW.
C     THE SUBROUTINE NEWRED HAS THE FOLLOWING CALLING SEQUENCE:
C           CALL NEWRED (*,*,NC,IV,OPS,FAC,LOC,IDUMP)
C WHERE
C       * - MEMORY LOCATION IN CALLING PROGRAM FOR RETURN IF ERRORS
C           ARE ENCOUNTERED.
C           INPUT DATA.
C       * - MEMORY LOCATION IN CALLING PROGRAM FOR RETURN AT END OF
C       NC - NOISE CURVE SET NUMBER RETURNED TO CALLING PROGRAM BY
C            NEWRED.
C       IV - VARIABLE OF DIMENSION 8 WHICH CONTAINS THE FLIGHT
C            IDENTIFICATION CODES CONSTRUCTED BY NEWRED.  (SEE
C            SUBROUTINES MIXRD AND NEWMIX WITH RESPECT TO VARIABLE
C            IMPRAC.)
C       OPS - VARIABLE OF DIMENSION 24 CONTAING UP TO 8 SETS OF DAY/
C             EVENING/NIGHT OPERATIONS MULTIPLIED BY THE CALL
C             ARGUMENT FAC (BELOW).
C       FAC - OPERATIONS MULTIPLIER.  (SEE OPS ABOVE.)
C       LOC - IF = 1, CALLING PROGRAM IS NEWMIX.  OTHERWISE, CALLING
C             PROGRAM IS MIXRD AND LANDING PROFILE NUMBER MUST
C             ACCOMPANY LANDING OPERATIONS.
C       IDUMP - IF=0, RAW INPUT DATA NOT PRINTED.  OTHERWISE, IT IS
C               PRINTED.
C     THE SUBROUTINE NEWRED IS USED BY THE SUBROUTINES MIXRD AND

C NEWMIX.  SINCE NEWRED ONLY READS ONE INPUT DATA CARD PER CALL, IS
C WILL BE CALLED AS MANY TIMES AS THERE ARE MIX DATA CARDS IN THE

C DECK.
C     IN ADDITION TO THE CALLING ARGUMENTS, NEWRED GETS ITS INPUT

C DATA FROM THE RUN DECK AND FROM DATA TABLES IN LABELED COMMON.  THE
C FOLLOWING DISCUSSES THOSE TABLES.
C     COMMON
C     BLOCK        VARIABLE  DESCRIPTION
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C      /MIXDTA/    IA(8,50)  NUMBERS INDICATING NOISE CURVE SETS AND
C                            PERFORMANCE PROFILES FOR UP TO 50 AIRCRAFT
C                            TYPES AS FOLLOWS ASSUMING AIRCRAFT TYPE I.
C                            IA(1,I)  NOISE CURVE SET NUMBER
C                              (2,I)  PROFILE FOR 0-500 NAUTICAL MILES
C                              (3,I)  PROFILE FOR 500-1000 NAUTICAL
C                                     MILES
C                              (4,I)  PROFILE FOR 1000-1500 NAUTICAL
C                                     MILES
C                              (5,I)  PROFILE FOR 1500-2500NAUTICAL
C                                     MILES
C                              (6,I)  PROFILE FOR 2500-3500 NAUTICAL
C                                     MILES
C                              (7,I)  PROFILE FOR 3500-4500 NAUTICAL
C                                     MILES
C                              (8,I)  PROFILE FOR 4500 + NAUTICAL
C                                     MILES
C                  NAC         LARGEST AIRCRAFT DEFINITION NUMBER WHICH
C                              HAS BEEN DEFINED
C                  TALLY       CUMULATIVE OPERATIONS FOR DAY/EVENING/
C                  (6,3,50)    NIGHT, LANDING AND 7 TAKEOFF STAGE LENGHTS
C                              FOR UP TO 50 DEFINED AIRCRAFT TYPES.
C     COMMON BLOCK VARIABLE DESCRIPTION
C     /TRACK/ ITP(99) DEFINED TRACKS HAVE A RUNAWAY NUMBER IN THIS TABLE
C     IN THE SAME POSITION AS THE TRACK NUMBER. OTHER WISE, THE VALUE IN A
C      POSITION IS EQUAL TO ZERO. NEWRED USED THIS VARIABLE TO CHECK THAT
C     A USER-REQUESTED TRACK HAS BEEN DEFINED.
C     /RUNWAY/ RL(10) CONTAINS THE LENGTHS OF THE RUNWAYS. USED BY NEWRED
C     TO ASSURE THAT TAKEOFFS HAVE ENOUGH ROOM.
C     /PROFIL/ PROF(4,10,10)) AIRCRAFT PERFORMANCE PROFILES USED IN
C     CONJUNCTION WITH THE RUNWAY LENGTHS AS DESCRIBED ABOVE.
C     /RWYTBL/ RUSE(2) THE RUNWAY LENGTHS AS DESCRIBED ABOVE.
C     RUNWYT / RUSE(3,2,5) CUMULATIVE DAY/EVENING/NIGHT OPERATIONS FOR
C     TAKEOFF #1 AND LANDING #2 FOR EACH DEFINED RUNWAY. RUNWAY
C     UTILIZATION PERCENTAGES WILL BE COMPUTED FROM THIS TABLE.
C     THERE ARE THREE EXIT RETURNS IN SUBROUTINE NEWRED, LOCATED AT LINES
C     NUMBERED 21,13 AND 99 IN THE SUBROUTINE LISTING IN SECTION 5. THE
C     RETURN AT LINE 21 IS AN ALTERNATE RETURN USED WHEN THE END-OF-DATA
C     CARD (A 9 AND CARD) IS READ BY NEWRED. THE RETURN AT LINE 99 IS AN
C     ERROR RETURN AND IS USED IF NO ERRORS WERE ENCOUNTERED. THE RETURN
C     AT LINE 13 IS AN ERROR RETURN AND IS USED IF ANY ERRORS WERE
C     ENCOUNTERED. THE RETURN AT LINE 21 IS THE NORMAL RETURN AFTER
C     PROCESSING AN AIRCRAFT OPERATIONS CARD.
C     IN ADDITION TO THE ABOVE EXIT RETURNS, THERE IS ONE EXIT
C     TERMINATION AT LINE NUMBER 25. THIS EXIT IS USED IF NEWRED
C     DETERMINES THAT THERE ARE NO PROPERLY DEFINED AIRCRAFT AT ALL IN THE
C     TABLE AS PREVIOUSLY DISCUSSED. EXECUTION OF THE PROGRAM IS
C     TERMINATED WITH THIS EXIT.
C     THE OUTPUT OF NEWRED IS THROUGH THE CALLING ARGUMENTS AND LABELED
C     COMMON BLOCKS PREVIOUSLY DISCUSSED.
C     THE PROCESSING PERFORMED BY NEWRED IS PRIMARILY HOUSKEEPING IN
C     NATURE IN ADDITION TO A VARIETY OF CHECKS ON THE DATA. INFORMATIVE
C     MESSAGES REGARDING WARNING OR ERROR CONDITIONS ARE PRINTED FOR THE
C     USER.
C     THE FIRST ALTERNATE ENTRY POINT IN NEWRED IS AT EQUOPS AND THE
C     CALLING SEQUENCE IS:
C     CALL EQUOPS (OPS,EQOPS,WE,YR)
C     WHERE
C     OPS - SAME AS DEFINED IN NEWRED.
C     EQOPS - EQUIVALENT OPERATIONS COMPUTED BY EQUOPS.
C     WE - EVENING OPERATIONS WEIGHTING FACTOR.
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C   W - NIGHT OPERATION WEIGHTING FACTOR.
C  EQUOPS DOES NOT USE ANY EXTERNAL SUBROUTINES.
C  EQUOPS IS CALLED BY THE SUBROUTINES MIXRD AND NEWMIX. IT WILL BE
C  CALLED MANY TIMES DURING EXECTION.
C  THE INPUT DATA TO EQUOPS IS PROVIDED ENTIRELY BY THE CALLING
C  ARGUMENTS.
C  THERE IS ONLY ONE EXIT RETURN FROM EQUOPS AND IT IS USED UNDER ALL
C  CONDITIONS. THE OUTPUT FROM EQUOPS IS PASSED TO THE CALLING PROGRAM
C  THROUGH THE CALLING ARGUMENT EQUOPS.
C  THE PROCESSING PERFORMED BY EQUOPS IS FORMULATED AS FOLLOWS FOR
C  EQUIVALENT OPERATIONS:
C  EQUOPS(I) = D(I)*10**F(I(*EN*N(I)
C  WHERE D(I),E(I),F(I) ARE THE DAY/EVENING/NIGHT OPERATIONS FROM OPS
C  EQOP ,WE,WN ARE CALLING ARGUMENTS
C  THE SECOND ALTERNATE ENTRY IN NEWRD IS CLRTAL AND CALLING SEQUENCE
C  IS:
C  CALL CLRTAL
C  CLRTAL USES THE EXTERNAL SUBROUTINE ZERO.
C  CLRTAL IS CALLED BY ROUTINE MIXRD AND NEWMIX.
C  THERE IS NO INPUT DATA TO CLRTAL.
C  THERE IS ONE EXIT RETURN IN CLRTAL AND IT IS ALWAYS USED.
C  THERE IS NO OUTPUT FROM CLRTAL.
C  THE PROCESSING PERFORMED BY CLRTAL CONSISTS OF SETTING THE VALUES IN
C  THE TABLES NUSE AND DAILY IN LABEL COMMON BLOCK/RWYUTL/TO ZERO.
C  THE THIRD ENTRY TO NEWRD IS AT DMPTAL AND IS CALLING SEQUENCE IS:
C  CALL DMPTAL
C  DMPTAL USES THE EXTERNAL SUBROUTINE ZERO.
C  THE SUBROUTINES MIXRD AND NEWMIX CALL DMPTAL. DMPTAL MAY BE CALLED
C  MANY TIMES DURING EXECTION.
C  THE INPUT DATA TO DMPTAL IS PROVIDED THROUGH LABELED COMMON BLOCKS
C  /RWYUTL/ AND /MIXDTA/.
C  THERE IS ONE EXIT RETURN FROM DMPTAL LOCATED AT LINE NUMBER 214 IN
C  THE SUBROUTINE LISTING IN SECTION 5. THIS RETURN IS USED UNDER ALL
C  CONDITIONS.
C  THE OUTPUT FROM DMPTAL IS, FOR THE MOST PART, PRINTED ON THE LINE
C  PRINTER.
C  HOWEVER, VARIABLES DEFTOT IN LABELED COMMON BLOCK /DEFALT/ AND IRBIG
C  IN LABELED COMMON BLOCK /RWYUTL/ ARE ASSIGNED VALUES.
C  THE PROCESSING PERFORMED BY DMPTAL CONSISTS OF PRINTING THE TABLE
C  NUSE IN AN APPROPPIATE FORMATE AND COMPUTING AND PRINTING THE RUNWAY
C  UTILIZATION NUMBERS. ALSO, THE TOTAL OPERATIONS ARE COMPUTED AND THE
C  BUSIEST TAKEOFF RUNWAY IS DETERMINED.
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Subroutine NOISRD

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      SUBROUTINE NOISRD(IGO,ICNT)                                    03-26-79

C THIS SUBROUTINE TOTALLY REWRITTEN FOR VERSION 2                    03-29-79

C                                                                    03-29-79

C       LOCAL VARIABLE DICTIONARY                                    03-29-79

C  BUF  - ARRAY FOR TEMPORARY STORAGE OF NOISE TABLE                 03-29-79
C  IND  - EQUALS 1 IF CURRENT NOISE CURVE IS NOT USED                03-29-79
C  IP   - COUNTER INCREMENTED EACH TIME A NEW THRUST LEVEL IS READ   03-29-79
C  IT   - EQUALS 1 IF 1ST TABLE IS BEING READ                        03-29-79
C         EQUALS 2 IF 2ND TABLE IS BEING READ                        03-29-79
C  K    - NOISE CURVE I.D. (ORDINAL)                                03-29-79
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C  MM    - HOLDS CHARACTERS TO BE PRINTED                                  03-29-79
C  N     - CURRENT NOISE CURVE I.D. (AS READ IN)                           03-29-79
C  NN    - NOISE MEASURE OF THE TABLE BEING PROCESSED                      03-29-79
C  PMAX  - NEW MAXIMUM REFERENCE THRUST                                    03-29-79
C  PMIN  - NEW MINIMUM REFERENCE THRUST                                    03-29-79
C                                                                          03-29-79
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Subroutine NWASDS

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      SUBROUTINE NWASDS (IIC,NPTS)
C
C     ******************************************************************
C
C      A - COS(ANGLE)
C
C     ANGINC - BRANCH ANGLE STEP SIZE
C      ANGLE - RUNNY ANGLE FOR POINT CONTOUR SEARCH
C      ANGS - TABLE OF COS EXPOSURES
C      B - SIN (ANGLE)
C      C - AT RIGHTS OF THE ALLOWABLE DISTANCE BETWEEN CONTOUR POINTS
C      DCTS - THE ALLOWABLE DISTANCE BETWEEN CONTOUR POINTS
C      EMAX - ENDING  EXPOSURE VALUE
C      SEARCH UNIT GRADIENT VECTOR, POINTS TOWARDS GREATEST EXPOSURE INCREASE
C      IIC - ERROR RETURN
C      IIK - VARIABLE INDEX - SHOWS SOME IMAGINATION IN CHOICE OF NAME
C      IKT - NNN...
C      I - RETURN FROM CALLED, STATUS OF CANDIDATE POINT, NONZERO MEANS NO GOOD
C      MM - AS M , PASSED TO CKPOIN
C      M - LOOP ARGUMENT (PERHAPS) INCREMENTED
C      MEX1 - NOISE EXPOSURE AT P1
C      NOBS - NUMBER OF OBSERVERS;
C      NPTS - NUMBER OF CONTOUR POINTS
C      NUMALT - NUMBER OF ALTERNATE METRIC
C      NUMPR - NUMBER OF PRIMARY METRIC
C      P1 - PREVIOUS CONTOUR POINT
C      P2 - FIRST GUESS AT POSITION OF NEXT CONTOUR POINT
C      PIN - X AND Y COORDS OF NEXT CANDIDATE CONTOUR POINT
C      PCN - P2 MEM
C      SANGLE - STARTING ANGLE FOR CIRCULAR POINT SEARCH
C     SVAL -  STARTING  EXPOSURE VALUE
C     )SEARCH FOR VALUE IN BOUNDS OF LAST POINT(
C     TANGLE - ROTATION INCREMENT BETWEEN PREVIOUS TWO CENTER POINTS )CURVED SEG
C      TOL - CONTOUR TOLERANCE
C      TOLC - SPARE COPY OF TOL, NEVER CLOBBERED
C      TOLLOP - PROXIMITY TO CONTOUR FACTOR FOR LOOP CHECK COMPUTATION
C      VAL - CONTOUR VALUE (LEVEL)
C      VMAX - VAL PTS TO
C      VMIN - VAL MINUS TOL
C      V0 - TABLE OF PREPARED POINT SEARCH LOCATIONS (TRIAL POINTS)
C      X - PREVIOUSLY COMPUTED CONTOUR X COORDS
C      Y - Y COORDS OF PREVIOUSLY COMPUTED CONTOUR POINTS
C     XX - OLDX - INCREMENT BETWEEN PREVIOUS TWO POINTS ON CONTOUR
C     YY - OLDY - INCREMENT BETWEEN PREVIOUS TWO POINTS ON CONTOUR
C  NWASDS-SUBROUTINE
C  NWASDS PERFORMS THE SAME FUNCTION AS NEWPNT BUT FOR ASDS AND DOSE
C  CONTOURS.
C  NWASDS CALLS THE SUBROUTINES CKLOOP, EXPOSE, VADD, VTRN, VSCL, VSTB
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C  AND NWAS.
C  THERE IS ONLY ONE ENTRY TO NWASDS AND THE CALLING SEQUENCE IS:
C  CALL NWASDS(*,NPTS)
C  WHERE
C  *= MEMORY LOCATION IN CALLING PROGRAM FOR ERROR RETURN.
C  NPTS - THE NUMBER OF CONTOUR POINTS THAT HAVE ALREADY BEEN COMPUTED.
C  THE MAIN PROGRAM, NOISI, IS THE ONLY USER OF NWASDS.
C  THE INPUT DATA FOR NWASDS IS IDENTICAL TO THAT FOR NEWPNT.
C  THERE ARE TWO EXIST RETURNS FROM NWASDS, LOCATED AT LINES NUMBERED
C  60 AND 183 IN THE SUBROUTINE LISTING IN SECTION 5. THE RETURN AT
C  LINE 60 IS A NORMAL RETURN USED WHEN A POINT ON THE CONTOUR HAS BEEN
C  FOUND. THE RETURN AT LINE 183 IS AN ERROR RETURN AND IS USED WHEN A
C  VALID POINT CANNOT BE FOUND AND WILL CAUSE COMPUTATIONS ON THE
C  CURRENT CONTOUR TO BE TERMINATED.
C      THE OUTPUT FROM NWASDS IS IDENTICAL TO THE SUBROUTINE NEWPNT.
C      WHILE THE PROCESSING PERFORMED BY NWASDS IS CONCEPTUALLY THE
C  SAME AS NEWPNT, THERE IS A SUBTLE DIFFERENCE IN THE HANDLING OF THE
C  ASDS METRIC, PARTICULARLY THE ZERO-TIME CONTOUR FOR ANY GIVEN
C  THRESHOLD.  THE INHERENT DISCONTINUITY OF THE NOISE EXPOSURE
C  (I.E., TIME ABOVE THRESHOLD) ALONG THIS BORDER IS THE  IS THE REASON
C  THAT NWASDS WAS WRITTEN.  THE SUBROUTINE NEWPNT IS INCAPABLE OF
C  PROCESSING THIS SPECIFIC CASE.
C      IN THE ACTUAL PROCESSING, THE IDENTICAL POINT SEARCH PATTERNS,
C  BOTH NORMAL AND ALTERED (IN CASE OF LOOPING CONDITIONS) ARE
C  EXECUTED, AS WELL AS INLET AND FINGER CROSSING CRITERIA CHECKS,
C  LOOPING CHECKS AND TOLERANCE CHECKS AS THOSE IN NEWPNT WITH THE
C  EXCEPTION OF THE SPECIAL HANDLING OF THE ZERO-TIME CONTOUR.
C      THE SPECIAL HANDLING OF THE ZERO-TIME CONTOUR CONSISTS OF
C  PERFORMING A ONE-SIDED TOLERANCE CHECK RATHER THAN TWO-SIDED AS IN
C  NEWPNT.  ALSO, A COMPUTED VALUE OF ZERO TIME FOR A TRIAL POINT
C  INDICATES NOTHING ABOUT HOW CLOSE IT IS TO THE CONTOUR UNLESS
C  ANOTHER POINT HAS BEEN CALCULATED WITH A NONZERO VALUE AND THEN IT
C  MAY BE ASSUMED THAT THE CONTOUR IS BETWEEN THE TWO POINTS.
C      SINCE THE BASIC CONCEPTS HAVE ALREADY BEEN DISCUSSED FOR
C  SUBROUTINE NEWPNT, THE FOLLOWING WILL RELATE THE PROCESSING
C  PERFORMED TO THE VARIOUS SECTIONS OF THE PROGRAM (REFER TO THE
C  SUBROUTINE LISTING IN SECTION 5.).
C  LINES 14 TO 38  NORMAL SEARCH PATTERN POINT SET-UP.  THE PATTERN IS
C  DOUBLE-SIDED BUT ONLY ONE SIDE WILL BE USED.
C  LINE 52  ONE SIDED TOLERANCE SET-UP FOR ZERO-TIME CONTOUR.
C  LINE 56  NOISE EXPOSURE COMPUTATION AT FIRST TRIAL POINT.
C  LINES 57 TO 61  EXIT SEQUENCE WHEN A POINT ON THE CONTOUR HAS BEEN
C  FOUND.
C  LINES 64 TO 105  NORMAL SEARCH PATTERN EXECUTION.
C  LINES 107 TO 147  ALTERED SEARCH PATTERN EXECUTION.
C  LINES 148 TO 197  INTERPOLATION BETWEEN TWO POINTS STRADDLING THE
C  CONTOUR.
C
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Subroutine OVRLAY

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      SUBROUTINE OVRLAY (IISO,KTRAK,NTSS,NPSS,DD,KPS,NPCAS,WW)
C
C     ******************************************************************
C      LOCAL VARIABLE DICTIONARY
C      ASPPCP - ASDS PERFORMACE PROFILE
C      DATC - TURN ANGLE
C     D: DISTANCE MEASURED ALONG GROUND TRACK FROM RUNWAY THRESHOLD
C     TO THE POINT WHERE THE AIRCRAFT TRACKING BEGINS (USUALLY THE
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C     POINT ON THE GROUND CLOSEST TO THE FIRST OBSERVER).
C      DW - DIFFERENCE BETWEEN REMAINING GROUND TRACK SEGMENT AND
C                 REMAINING PROFILE SEGMENT
C      FLTREP - FLIGHT PATH INFO (SEE BELOW...)
C      IER - ERROR RETURN
C      ITSEG - CONTAINS THE NUMBER OF TRACK SEGMENTS FOR A GIVEN TRACK
C                IN THE LOW ORDER 5 BITS OF THE WORD (CF SUBR HBT)
C     KFS: NUMBER OF FLIGHTPATH SEGMENTS AS ASSEMBLED BY OVRLAY
C     (CALCULATED BY OVRLAY)
C      KPS - PROFILE SEGMENT COUNTER
C     KTRAK: INDICATES THE TRACK NUMBER FOR USE IN ARRAY PARA IN
C     COMMON BLOCK TRACK.
C      KTS - TRACK COUNTER
C      LOOP - HAS P BEEN FOUND
C      LEXT - IS THIS AN EXTENSION OF THE PREVIOUS SEGMENT
C      LINIT - IS THIS THE VERY FIRST SEGMENT
C      LPS - SHOULD PROFILE SEGMENT COUNTER BE INCREMENTED
C      LTS - SHOULD TRACK SEGMENT COUNTER BE INCREMENTED
C      LZ - IS THERE ZERO REMAINING LENGTH IN CURRENT SEGMENT
C      MASK - DECODES ARGS IN IFAC
C      MNPSP1 - MAX NUMBER OF SEGMENTS IN PROFILE
C      MXPS - MAX NUMBER OF PROFILE SEGMENTS ALLOWED BY ARRAY DIMENSIONING
C      MXTS - MAX NUMBER OF TRACK SEGMENTS ALLOWED BY ARRY DIMENSIONING
C      N - LOOP COUNTER, SOMETIMES POINTS TO NPSP1
C     TRACKING BEGINS.  (CALCULATED BY OVRLAY)
C     NPCAS: THE NUMBER OF THE SEGMENT IN ARRAY FLTREP WHERE AIRCRAFT
C     NPSS+NUMBER OF PROFILE SEGMENTS
C     NTSS+NUMBER OF TRACK SEGMENTS
C      P - SCRATCHPAD PROFILE SEGMENT
C      PARA - ALIAS PARA IN OTHER ROUTINES (A/C INFO)
C      R - REMAINING LENGTH OF LAST PROFILE SEGMENT
C      RPS - REMAINING PROFILE SEGMENT LENGTH
C      RR - GROUND TRACK RADIUS
C      RP1 - R OF PREVIOUS SEGMENT
C      RTS - LENGTH OF CURRENT SEGMENT
C     W=THE DISTANCE MEASURED ON THE GROUND TRACK, FROM THE BEGINNING
C     OF THE NPCAS-TH SEGMENT TO THE POINT WHERE TRACKING BEGINS
C     (CALCULATED BY OVRLAY).
C  OVRLAY - SUBROUTINE
C  SUBROUTINE OVRLAY CONSTRUCTS THE FLIGHT PATH GEOMETRY VARIABLES FROM
C  FLIGHT TRACK DEFINITIONS AND ALTITUDE PROFILES FOR THE POSITIONAL
C  CALCULATIONS RELATING OBSERVER AND AIRCRAFT USED FOR ADDS AND DOSE
C  CONTOUR COMPUTATIONS.
C  THE SUBROUTINE OVRLAY DOES NOT USE EXTERNAL SUBROUTINES.
C  OVRLAY HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS
C  CALL OVRLAY (*, RTSLF, NTS, NPS, D, KFS, NPCAS, W)
C  WHERE
C  * - RETURN LOCATION IN CALLING PROGRAM FOR ERROR RETURN.
C  RTSLF - GROUND TRACK NUMBER.
C  NTS - TOTAL NUMBER OF SEGMENTS IN THE TRACK.
C  NPS - TOTAL NUMBER OF PERFORMANCE PROFILE SEGMENTS.
C  D - DISTANCE ALONG THE GROUND TRACK, FROM THE BEGINNING, TO WHERE
C  AIRCRAFT TRACKING IS TO START.  USUALLY, THIS AT THE POINT OF
C  CLOSEST APPROACH.
C  KFS - NUMBER OF "FLIGHT PATH" SEGMENTS ASSEMBLED BY OVRLAY.

C  NPCAS - THE NUMBER OF THE "FLIGHT PATH" SEGMENT TO START AIRCRAFT

C  TRACKING.
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C   S - THE DISTANCE FROM THE BEGINNING OF SEGMENT NUMBER NPCAS TO
C   THE POINT WHERE AIRCRAFT TRACKING BEGINS.
C        THE SUBROUTINE TIHIST IS THE ONLY USER OF OVRLAY.  THE SUBROUTINE
C   WILL BE CALLED ONCE PER FLIGHT AND HENCE, MANY TIMES DURING THE
C   EXECUTION INVOLVING ASDS OR DOSE CALCULATIONS.
C        THE INPUT DATA TO OVRLAY IS PROVIDED BY BOTH THE CALLING
C   ARGUMENTS AND LABELED COMMON BLOCK /TRACK/.  SEE THE DISCUSSION FOR
C   SUBROUTINE [illegible] FOR A DESCRIPTION OF THE CONTENTS OF THIS BLOCK,
C   SPECIFICALLY THE GROUND TRACK DEFINITIONS CONTAINED IN THE VARIABLE
C   PARAM.  NOTE THAT THE VARIABLE IS REFERRED TO AS PARA IN OVRLAY.
C        THERE ARE TWO EXIT RETURNS FROM OVRLAY LOCATED AT LINES NUMBERED
C   [illegible] AND 309 IN THE SUBROUTINE LISTING IN SECTION [illegible].  THE RETURN AT
C   LINE NUMBER [illegible] IS THE NORMAL RETURN USED IF NO ERRORS ARE
C   ENCOUNTERED.  THE RETURN AT LINE [illegible] IS AN ERROR RETURN AND IS USED
C   WHEN A VALID CONTOUR POINT CANNOT BE FOUND AND WILL CAUSE
C   COMPUTATIONS ON THE CURRENT CONTOUR TO BE TERMINATED.
C   RETURN AT LINE [illegible] IS THE NORMAL RETURN USED IF NO ERRORS ARE
C   ENCOUNTERED.  THE RETURN AT LINE 30[illegible] IS AN ERROR RETURN AND IS USED
C   AFTER AN ERROR HAS BEEN ENCOUNTERED AND AN ERROR MESSAGE PRINTED ON
C   THE LINE PRINTER (SEE LINES [illegible] TO [illegible]).  THIS RETURN WILL CAUSE THE
C   EXECUTION TO BE TERMINATED.
C        IN ADDITION TO THE CALLING ARGUMENTS, THE OUTPUT FROM OVRLAY
C   CONSISTS OF THE CONTENTS OF THE VARIABLE FLITEP IN LABELED COMMON
C   BLOCK /[illegible]/.  FOR A DETAILED DESCRIPTION OF THE CONTENTS OF FLITEP
C   [illegible] LINES [illegible] THROUGH [illegible] IN THE SUBROUTINE LISTING IN SECTION [illegible].
C        THE PROCESSING PERFORMED BY OVRLAY CONSISTS OF MERGING THE
C   GROUND TRACK DEFINITIONS WITH THE AIRCRAFT PERFORMANCE PROFILE
C   DEFINITIONS TO CONSTRUCT A SINGLE DEFINITION FOR THE AIRCRAFT FLIGHT
C   PATH.  OTHER AIRCRAFT CHARACTERISTICS SUCH AS VELOCITY AND POWER
C   SETTINGS ARE CORRELATED WITH ALTITUDE AND DISTANCE ALONG THE PATH.
C   THIS DEFINITION WILL BECOME THE ONE USED BY TIHIST AND OTHER RELATED
C   SUBROUTINES TO SIMULATE THE AIRCRAFT FLYBY IN THE REGION WHERE THE
C   MINIMUM THRESHOLD NOISE LEVEL IS EXCEEDED.
C
C      [illegible]: [illegible] TYPE OF ARGUMENT, USED FOR ERROR RETURN.
C      [illegible]: [illegible] THE TRACK NUMBER FOR USE IN ARRAY PARA IN
C      [illegible].
C      NTS: NUMBER OF TRACK SEGMENTS
C      NPS: NUMBER OF PROFILE SEGMENTS
C      D: DISTANCE MEASURED ALONG GROUND TRACK FROM RUNWAY THRESHOLD
C      TO THE POINT WHERE THE AIRCRAFT TRACKING BEGINS (USUALLY THE
C      POINT ON THE GROUND CLOSEST TO THE FIRST OBSERVER).
C      NFS: NUMBER OF FLITEPATH SEGMENTS AS ASSEMBLED BY OVRLAY
C      (CALCULATED BY OVRLAY)
C      NPCAS: THE NUMBER OF THE SEGMENT IN ARRAY FLITEP WHERE AIRCRAFT
C      TRACKING BEGINS.  (CALCULATED BY OVRLAY)
C      S: THE DISTANCE MEASURED ON THE GROUND TRACK, FROM THE BEGINNING
C      OF THE NPCAS-TH SEGMENT TO THE POINT WHERE TRACKING BEGINS
C      (CALCULATED BY OVRLAY).
C      THE STRUCTURE OF [illegible] TRACK IS EXACTLY AS FOUND IN
C      VOL 2, OF AIRPORT REPORT.
       DIMENSION PARA(5,1[illegible],9[illegible])
       EQUIVALENCE(PARAM,PARA)
       DIMENSION P(5,1[illegible])
C      [illegible] CONTAINS THE PROFILE INFORMATION IN A FORMAT ALMOST
C      THE SAME AS DESCRIBED IN VOL 2, OF AIRPORT REPORT.
C      ONLY DIFFERENCE - DISTANCES ARE MEASURED FROM THE FAR END
C      RUNWAY THRESHOLD, IRRESPECTIVE OF WHETHER IT IS A TAKEOFF OR
C      A LANDING.  OVRLAY DOESN'T EVEN KNOW WHETHER A T/O OR LANDING IS
C      BEING TREATED.
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C     ANALYSIS TASK IS TO FILL CORRECTLY ARRAY FLITEP WITH INFORMATION
C     FOR EACH SEGMENT OF A GROUND TRACK GEOMETRY, ALTITUDE, SPEED,
C     AND THRUST.
C     IF THE FIRST INDEX IS              THE CONTENTS OF FLITEP( , ) IS
C
C     1                                  0. FOR STRAIGHT SEGMENT
C                                        1. FOR CIRCULAR SEGMENT
C     2                                  STRAIGHT - X-COORD. OF SEGMENT
C                                             STARTING POINT
C                                        CIRCULAR - X-COORD. OF TURN
C                                             CENTER
C     3                                  STRAIGHT - Y-COORD OF SEGMENT
C                                             START POINT
C                                        CIRCULAR - Y-COORD OF TURN
C                                             CENTER
C     4                                  STRAIGHT - LENGTH OF SEGMENT
C                                        CIRCULAR - RADIUS. POSITIVE IF
C                                             TURNING LEFT, NEGATIVE IF
C                                             TURNING RIGHT (LOOKING
C                                             IN A DIRECTION AWAY FROM
C                                             THE RUNWAY, I.E. AS IF
C                                             IT WERE A T/O)
C     5                                  STRAIGHT - X-COMPONENT OF
C                                             UNIT VECTOR IN DIRECTION
C                                             OF SEGMENT
C                                        CIRCULAR - TURN ANGLE
C     6                                  STRAIGHT - Y-COORD. OF UNIT
C                                             VECTOR IN DIRECTION OF
C                                             SEGMENT
C                                        CIRCULAR - ANGLE BETWEEN LINE
C                                             FROM TURN CENTER TO
C                                             SEGMENT START, WITH
C                                             POSITIVE X-AXIS
C     7                                  ALTITUDE AT SEGMENT START
C     8                                  SPEED IN KNOTS AT SEGMENT START
C     9                                  THRUST OVER SEGMENT IN LBS/
C                                             ENGINE
C     NOTE - ALL DISTANCES IN FEET, ALL ANGLES IN RADIANS
```

Subroutine POSCOO

```
      SUBROUTINE POSCOO (IVISI,TT,WW,FSEG)
C
C     ******************************************************************
C     C - X-COORD INCREASE DURING SEGMENT )AIRPORT FRAME (
C     C - LENGTH OF SEGMENT ALONG _X_ DIRECTION )FROM XI - WHICH COORD FRAME(
C     FLITEP- AIRCRAFT FLIGHT PATH DEFINITION
C     FSEG - SEGMENT NUMBER
C      FSEGPP-      NUMBER OF PREVIOUSLY EXAMINED TRACK SEGMENTS
C      FSAME-       LOGICAL VARIABLE
C     IVISI - FLAG TO TEST IF _SAME_ SEGMENT
C       NPTS    MAXIMUM NUMBER OF SEARCH POINTS ) AS KNOWNS (
C     NPTSP1-   MAXIMUM NUMBER OF SEARCH POINTS, FIRST PASS) NOT USED (
C     PSI - FRACTION OF TURN ANGLE TRAVERSED
C     R - LENGTH OF SEGMENT )STORED IN FLITEP(
C       RA-   ABSOLUTE VALUE OF SEGMENT LENGTH
C     S - Y-COORD INCREASE ETC
C     TIL - DISTANCE FROM ORIGIN OF VA
C      TA-  AMOUNT OF TURN ANGLE TRAVERSED
C     V1-   THE XYZ-COORDINATE POSITION OF THE AIRCRAFT
C     V11 - END POINT OF SEGMENT RELATIVE TO STARTPOINT )WHOSE REFERENCE FRAME
C     (
C     VALPHA-  UNIT VECTOR COMPONENTS FOR ALPHA IN THE AIRCRAFT
C        REFERENCE FRAME
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C      "BETA-  UNIT VECTOR COMPONENTS FOR BETA IN THE AIRCRAFT
C       REFERENCE FRAME
C     VC - STRAIGHT SEGMENT START POINT> CURVED SEGMENT TURN CENTER
C      VR-  POSITION OF SEGMENT END POINT ) FROM FLITER (
C     WP - DISTANCE FROM SEGMENT STARTING POINT
C     YI - ELEVATION ANGLE OF SEGMENT
C     TO UNDERSTAND WHAT POSCOO IS DOING, AN EXAMINATION OF THE
C     DISCUSSION IN THE WYLE BOOK WITH THE ACCOMAPNYING
C     DIAGRAM IS VERY NECESSARY )OR A VERY GOOD
C     UNDERSTANDING OF COORDINATE TRANSFORMATIONS
C     BETWEEN REFERENCE FRAMES MOVING RELATIVE TO EACH OTHER,
C     AS ELEMENTARY AS THEY SEEM(
C POSCOO - SUBROUTINE
C SUBROUTINE POSCOO COMPUTES THE POSITION VECTOR OF AN OBSERVER
C RELATIVE TO THE AIRCRAFT IN THE AIRCRAFT REFERENCE COORDINATE
C SYSTEM.
C POSCOO HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS:
C CALL POSCOO (LXTSI,TL,W,KSEG)
C WHERE
C LXTSI - A LOGICAL VARIABLE WHICH IS TRUE FOR THE FIRST CALL TO
C POSCOO FOR A FLIGHT AND FALSE OTHERWISE.
C TL - +1.0 FOR TAKEOFF, -1.0 FOR LANDING.
C W - HORIZONTAL DISTANCE ALONG CURRENT SEGMENT, IN FEET, FROM THE
C BEGINNING OF THE SEGMENT TO THE ANALYSIS POSITION.
C KSEG - THE NUMBER OF THE SEGMENT BEING ANALYZED IN THE FLIGHT PATH
C DEFINITION.
C      THE SUBROUTINE TIMISI IS THE ONLY USER OF SUBROUTINE POSCOO AND
C CALLS IT DURING THE FLYBY SIMULATION TO DETERMINE THE POSITION
C COORDINATES OF THE AIRCRAFT AND UNIT VECTORS IN THE AIRCRAFT
C REFERENCE FRAME.  THESE QUANTITIES ARE NEEDED FREQUENTLY WHICH
C NECESSITATES MANY CALLS TO POSCOO.
C      THE INPUT DATA TO POSCOO IS PROVIDED BY THE CALLING ARGUMENTS AS
C WELL AS BY LABELED COMMON BLOCK /BLK2/.  THE INFORMATION IN /BLK2/
C IS THE FLIGHT PATH DEFINITION WHICH WAS CONSTRUCTED BY THE
C SUBROUTINE OVRLAY.
C      POSCOO HAS THREE EXIT RETURNS LOCATED AT LINES NUMBERED 26, 31
C AND 57 IN THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT LINE
C 26 IS USED FOR ALL BUT THE FIRST CALL FOR A SINGLE STRAIGHT FLIGHT
C PATH SEGMENT.  THE RETURN AT LINE 31 IS USED AFTER POSCOO HAS
C PROCESSED A STRAIGHT SEGMENT.  THE RETURN AT LINE 57 IS USED AFTER
C PROCESSING A CIRCULAR (HELICAL) SEGMENT.
C THE OUTPUT FROM POSCOO IS CONTAINED IN THE LABELED COMMON BLOCK
C /WORK/.  THE FOLLOWING DESCRIBES THE CONTENTS OF THAT BLOCK.
C VARIABLE        DESCRIPTION
C V               THE XYZ-COORDINATE POSITION OF THE AIRCRAFT.
C REFERENCE
C VA(3,3)         UNIT VECTOR COMPONENTS FOR (A) IN THE AIRCRAFT
C REFERENCE FRAME.
C
C VB(I,J)         UNIT VECTOR COMPONENTS FOR (B) IN THE AIRCRAFT
C REFERENCE FRAME.
C NOTE THAT BOTH (A) AND (B) ARE EXPRESSED IN TERMS OF (I) AND (J) IN
C THE AIRPORT FIXED COORDINATE SYSTEM.
C THE VERSION OF POSCOO PRESENTLY INCLUDED IN THIS MODEL IS A
C SIMPLIFIED APPROACH TO A MORE COMPLEX VERSION WHICH IS IN A STAGE OF
C CHECKOUT.  SPECIFICALLY, THE FUNCTIONS PERFORMED BY THE MORE COMPLEX
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C  VERSION THAT ARE NOT PERFORMED BY THE PRESENT VERSION ARE THE
C  COMPUTATION OF BANKING AND FUSELAGE ANGLES.  THE PRESENT VERSION
C  ASSUMES THAT THE AIRCRAFT IS HORIZONTAL AT ALL TIMES.  THE
C  MAGNITUDE OF THE ERROR, IF ANY, CAUSED BY THIS ASSUMPTION, HAS NOT
C  BEEN DETERMINED.
C      THE PROCESSING PERFORMED BY POSCO CONSISTS OF DEFINING THE
C  POSITION COORDINATES (XYZ IN THE CARTESIAN SYSTEM) OF THE AIRCRAFT AS
C  THE BASIS VECTORS FOR THE AIRCRAFT MOVING REFERENCE FRAME.
C  X, Y ARE THE COORDINATES OF THE PROJECTION OF THE HELIX CENTERLINE
C  ON THE GROUND PLANE.
C  Z IS THE ALTITUDE AT THE BEGINNING OF THE TURN.
C  GAMMA IS THE ANGLE OF THE POSITIVE X-DIRECTION AND A LINE THROUGH
C  THE  PROJECTION OF THE SEGMENT STARTING POINT AND THE COORDINATES
C  X, Y ABOVE.
C  PHI IS THE ANGLE INTO THE TURN FOR THE CURRENT AIRCRAFT POSITION.
C  R IS THE RADIUS OF THE TURN, POSITIVE FOR LEFT TURNS, NEGATIVE FOR
C  RIGHT WHEN ASSUMING A TAKEOFF OPERATION.
C      THE FOLLOWING IS A DESCRIPTION OF THE CODE.
C  LINES 18 TO 25 - COMPUTATION OF AIRCRAFT POSITION COORDINATES FOR
C  STRAIGHT SEGMENTS.
C  LINES 27 TO 30 - COMPUTATION OF (A) AND (B) FOR A STRAIGHT SEGMENT.
C  LINES 33 TO 48 - COMPUTATION OF AIRCRAFT POSITION COORDINATES FOR A
C  HELICAL SEGMENT.
C  LINES 51 TO 55 - COMPUTATION OF (A) AND (B) FOR A HELICAL SEGMENT.
C
```

Subroutine POSIT

```
      SUBROUTINE POSIT (LUNIT)
C
C         TAPE POSITIONING SUBROUTINE
C     ******************************************************************
C      POSIT - SUBROUTINE
C      SUBROUTINE POSIT POSITIONS A MAGNETIC DATA TAPE A BEGIN WRITING
C  BETWEEN THE FIRST DOUBLE-END-OF-FILE MARKS FOUND.
C      THE SUBROUTINE POSIT CALLS THE SUBROUTINE SKFIL.
C      POSIT HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS:
C                  CALL POSIT (LUNIT)
C  WHERE
C      LUNIT - THE LOGICAL UNIT NUMBER FOR THE MAGNETIC TAPE.
C      THE MAIN PROGRAM NOISE1 IS THE ONLY USER OF POSIT AND IT IS
C  CALLED ONLY ONCE PER EXECUTION RUN.
C      THE ONLY INPUT DATA FOR POSIT IS PROVIDED BY THE CALLING
C  ARGUMENT.
C      THERE IS ONE EXIT RETURN FROM POSIT AND IS USED UNDER ALL
C  CONDITIONS.
C      THE OUTPUT FROM POSIT IS THE NUMBER OF FILE MARKS PASSED ON THE
C  TAPE BEFORE TWO BACK-TO-BACK FILE MARKS WERE ENCOUNTERED.  THE
C  COUNT INCLUDES THOSE TWO FILE MARKS.  THE NUMBER IS STORED IN
C  ABELED COMMON BLOCK /DEFALT/ IN THE VARIABLE IFLDEF.
C
```

Subroutine POSMUT

```
      FUNCTION POSMUT (PWR1,PWR2,DISTS,DISTE,DISTA)
C
C     ******************************************************************
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```
C
C       THIS FUNCTION SMOOTHS THRUST CHANGES OVER THE FIRST
C       1000 FEET OF THE NEW PROFILE SEGMENT
C
C     POSMUT - VALUE FOR THRUST AT THE ANALYSIS POINT
C       PWR1 IS THE OLD THRUST
C       PWR2 IS THE NEW THRUST
C       DISTS IS THE START OF THE NEW SEGMENT
C       DISTE IS THE END OF THE NEW SEGMENT
C       DISTA IS THE POINT AT WHICH THE THRUST IS DESIRED
C
C       ABOVE STATEMENTS APPLY TO TAKEOFFS ONLY
C       FOR LANDINGS REVERSE INPUT START-END DISTANCES AND POWER SETTIN
      IF (ABS(DISTS-DISTE).GE.1000.) GO TO 10
C     POSMUT - FUNCTION SUBROUTINE
C     THE PURPOSE OF THE FUNCTION POSMUT IS TO SMOOTH THRUST
C  TRANSITIONS WHEN THEY ARE ENCOUNTERED IN THE AIRCRAFT PERFORMANCE
C  PROFILE.
C     POSMUT HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS:
C           CALL POSMUT (PWR1,PWR2,DISTS,DISTE,DISTA)
C  WHERE
C     PWR1  THE ORIGINAL THRUST (POUNDS PER ENGINE).
C     PWR2  THE FINAL THRUST (POUNDS PER ENGINE).
C     DISTS  THE GROUND DISTANCE FROM THRESHOLD TO THE START OF THE
C  SEGMENT AS THE AIRCRAFT FLIES IT (I.E., ONE END OF THE SEGMENT FOR A
C  TAKEOFF, THE OTHER END FOR A LANDING).
C     DISTE  THE GROUND DISTANCE FROM THRESHOLD TO THE END OF THE
C  SEGMENT AS THE AIRCRAFT FLIES IT.  (SEE COMMENT ABOVE.)
C     DISTA  THE GROUND DISTANCE FROM THRESHOLD TO THE POINT BEING
C  ANALYZED.
C     POSMUT IS THE ONLY USER OF POSMUT AND IT MAY BE CALLED MANY
C  TIMES DURING THE COMPUTATION OF ENERGY METRIC CONTOURS.
C     THE INPUT DATA FOR POSMUT IS PROVIDED BY THE CALLING ARGUMENTS.
C     THERE ARE TWO EXIT RETURNS FROM POSMUT LOCATED AT LINES NUMBERED
C  19 AND 23 IN THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT
C  LINE 19 IS USED WHEN THE SMOOTHING FUNCTION IS USED WHILE THE RETURN
C  AT LINE 23 IS USED WHEN THE ANALYSIS POINT IS BEYOND THE SMOOTHING
C  AREA.
C     THE OUTPUT FROM POSMUT IS A VALUE FOR THE THRUST AT THE ANALYSIS
C  POINT AND IS PASSED TO THE CALLING PROGRAM THROUGH THE FUNCTION
C     THE FUNCTION POSMUT SMOOTHES THRUST TRANSITIONS OVER 1000 FEET
C  GROUND DISTANCE.  WHEN AIRCRAFT THRUST CHANGES ARE DEFINED, IS
C  TIMED WITH GROUND DISTANCE AND THAT THE NEW THRUST WILL BE
C  REALIZED AT 1000 FEET GROUND DISTANCE AFTER THE CHANGE IS INITIATED.
C
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Subroutine PPGRM

```
      SUBROUTINE PPGRM (XX,YY,NPTS,LAST,MORE,NPIT,NRW,IGO)
C
C     ******************************************************************
C      LOCAL VARIABLE DICTIONARY
C      A - TOTAL EQUIVALENT T/C OPERATIONS 24 HPS
C      APIT - OUTPUT TITLE
C      AP - ANOTHER OUTPUT TITLE
C      B - TOTAL T/O OPERATIONS IN OPPOSITE DIRECTION TO A
C      BANNER - STILL ANOTHER OUTPUT TITLE
C      DATEP - DUMMY ARG TO CONTAIN DATE, FOR ALPHA OUTPUT
C      I - EVER POPULAR ALL PURPOSE LOOP COUNTER
C      IC - I COUNT
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C       IFLDEF - CURRENT FILE NUMBER (UPDATED)
C       IGO - ERROR RETURN
C       ITN - NUMBER OF POINTS IN CONTOUR
C       INCOR - NOT EQUAL ZERO INDICATES RUNWAY INSIDE
C       IPSTZ - MULTIPLE CONTOUR FLAG, ZERO MEANS SINGLE CLOSED CONTOUR
C       IP - LOOP COUNTER
C       IPBIG - NUMBER OF RUNWAY WITH MOST WEIGHTED T/O OPERATIONS
C       ITITL - CONTOUR TITL
C       IXR - COUNTS NUMBER OF DISTINCT CONTOUR THRESHOLDS
C       K - CURRENT RUNWAY NUMBER
C       L - NUMBER OF RUNWAY IN OPPOSITE DIRECTION TO K
C       LSTAT - RETURNS FILE STATUS (CONTOURS FROM TAPE)
C       METLEV - TABLE OF THRESHOLDS FOR THE SEVERAL METRICS IN USE
C       METLIT - ALPHAMERIC LITERAL OF CURRENT PRIMARY METRIC
C       MORE - INDICATES WHEN THE LAST POINT OF A PLOT HAS BEEN DONE
C       NAMR - ARRAY OF RUNWAY NAMES (SC CALLED)
C       NPLOT - FLAG INDICATES ANOTHER PLOT REMAINS
C       NPLT - NUMBER OF PLOT PRESENTLY BEING PROCESSED
C       NPTS - NUMBER OF POINTS CALCULATED THIS PAP
C       NRW - NUMBER OF DEFINED RUNWAYS
C       NRWY - NUMBER OF DEFINED RUNWAYS (PASSED IN COMMON)
C       TAIT - ANOTHER OUTPUT TITLE
C       RUSE - TABLE OF OPERATIONS PER RUNWAY
C       TRD - MORE TITLE RUBBISH
C       VAL - CONTOUR VALUE
C       X - X COORDINATES OF CONTOUR
C       XA - RUNWAY COORDS, ARRIVAL
C       XAR - CONTOUR AREA
C       XD - RUNWAY COORDINATES, DEPARTURE
C       XLG - MAXIMUM VALUE OF X IN PRESENT CONTOUR
C       XSM - MINIMUM VALUE OF X IN PRESENT CONTOUR
C       XX - CURRENT X COORDINATE
C       Y - Y COORDINATES OF CONTOUR
C       YLG - MAXIMUM VALUE OF Y IN PRESENT CONTOUR
C       YSM - MINIMUM VALUE OF Y IN PRESENT CONTOUR
C       YY - CURRENT Y COORDINATE
C       PRGRM - SUBROUTINE
C      THE SUBROUTINE PRGRM TABULATES THE CONTOUR POINT COORDINATES AS
C THEY ARE COMPUTED AND OUTPUTS THEM, ALONG WITH APPROPRIATE
C IDENTIFICATION INFORMATION, TO MAGNETIC TAPE UNLESS REQUESTED NOT TO
C BY THE USER.  ADDITIONALLY, PRGRM CAN REDIRECT IN-LINE PROCESSING AS
C AN OPTIONAL USER REQUEST.
C    PRGRM CALLS THE SUBROUTINE INSIDE AND SKFIL.
C      PRGRM HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS
C        CALL PRGRM (XX,YY,NPTS,LAST,MORE,NPLT,NRW,*)
C WHERE
C        XX - THE X-COORDINATE OF THE CONTOUR POINT
C        YY - THE Y-COORDINATE OF THE CONTOUR POINT
C        NPTS - THE NUMBER OF POINTS IN THE CONTOUR
C        LAST - IF NOT = 0, THIS IS THE LAST POINT ON THE CONTOUR
C
C        MORE - IF NOT = 0, THIS IS THE LAST CONTOUR IN THE FILE
C
C        NPLY - CURRENT CONTOUR NUMBER IN THIS FILE
C
C        NRW - NUMBER OF DEFINED RUNWAYS
C
C        * - MEMORY LOCATION IN CALLING PROGRAM FOR ALTERNATE RETURN
C        WHICH WILL REDIRECT IN-LINE PROCESSING
C      THE MAIN PROGRAM 'USER' IS THE ONLY USER OF PRGRM AND IT WILL BE
C CALLED AFTER EVERY POINT ON A CONTOUR HAS BEEN DETERMINED.
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C      THE INPUT DATA FOR PPGRM IS PROVIDED THROUGH THE CALLING
C  ARGUMENTS AND THE LABELED COMMON BLOCKS /RUNWAY/, FOR RUNWAY
C  COORDINATES,/TITLE/, FOR CONTOUR TITLES,/PLOTR/, FOR OPTIONAL
C  PERIPHERAL REQUEST (VARIABLE IPSIZ) AND THE CONTOUR AREA (VARIABLE
C  VARI), /BK/, FOR THE CONTOUR VALUES, /RWYUTL/, RUNWAY USE AND BUSIEST
C  TAKEOFF RUNWAY.
```

Subroutine PREPR

```
      SUBROUTINE PREPR (XP,DQ,RL,N,PWR,V,ITAC,NTRKK,MAXSEG,IAPP)        03-15-79
C
C     ************************************************************************
C      LOCAL VARIABLE DICTIONARY
C     ANG - ROTATION ANGLE, CURVED SEG
C     APA - AIRPORT ALTITUDE )CORRECTED (
C      APPTHR - TABLE OF THRUST SETTINGS (INPUT DATA)
C      ASPROF - ASDS PERFORMANCE PROFILE
C     AVEALT - AVERAGE ALTITUDE OVER SEGMENT AFTER RESTRICTION
C      BX1 - RADIUS OF SEGMENT
C     C1TYP1 - CUTBACK TYPE 1 INDICATOR
C     C3TYP3 - CUTBACK TYPE 3 INDICATOR
C     DALT -ALTITUDE LOSS FROM RESTRICTION
C      DD - DISTANCE ALONG PROFILE TO CURRENT POINT
C     DDIST - DISTANCE OVER WHICH RESTRICTION APPLIES
C     DEL - DELTA CORRECTION FOR THRUST VALUES
C      DIR - WIND DIRECTION RELATIVE TO PCS X AXIS
C     DS - SEGMENT LENGTH
C      ENDALT - HEIGHT ABOVE GROUND AT END OF CUTBACK PROCEDURE
C      ENDR - DISTANCE ALONG TRACK TO END OF CUTBACK PROCEDURE
C     GAMMA - VALUE OF RESTRICTION
C      GCRN - CLIMB GRADIENT DURING CUTBACK PROCEDURE
C     H -TRACK ELEVATION
C     IAPP - APPROACH PARAMETER I.D. (CRDINAL)                          03-29-79
C     ICBMOD - CUTBACK MODE
C      ICBNCP - INTEGER CUTBACK NUMBER CUTBACK OVERRIDE
C     ITAC - AIRCRAFT TYPE
C      IMR - FIRST 20 X COORDS OF CURRENT CONTOUR
C      ITRK - TRACK GROUP NUMBER
C      IISEG - NUMBER OF TRACK SEGMENTS PER TRACK IN LOW 7 BITS
C      JOINT - APPRO MODE
C      MATCH - MAPS A/C TYPES TO PROFILES
C      MASK - DECODES INTO FROM ITSEG
C     MAXSEG - LARGEST NUMBER OF SEGMENTS/TRACK
C     MXS - TRACK WITH NEXT GREATEST NUMBER OF SEGS  )MAXSEG-1(
C     N - TRACK GROUP NUMBER
C     NP - PROFILE NUMBER
C     NPS - NUMBER OF PROFILE SEGMENTS
C     NR - RESTRICTION NUMBER
C     NRT - RESTRICTION TYPE
C      NTAB - TABLE OF TRACK NUMBERS
C     NTRKK - TRACK NUMBER
C      PARAM - SEGMENT INFO FOR EACH TRACK  (SEE UBP)
C      PI - CONSTANT EQUALS THREE SOMETHING
C      PROF - TABLE OF PERFORMANCE PROFILES
C     PWR - THRUST SETTING
C     PWR1 - POWER SETTING TO CONFORM TO RESTRICTION
C     RL - RUNWAY LENGTH
C      RWYL - TABLE OF RUNWAY LENGTHS
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```
C     RWYLEN - RUNWAY LENGTH
C       HIGH - INDICATES HANDEDNESS OF TURN
C     JSTART - FIRST SEGMENT WITHOUT AFTER RESTRICTION APPLIED
C       STP - RESTRICTION STOPS HERE
C       STR - START OF RESTRICTION
C        TD - TABLE OF INCREMENTAL TRACK LENGTHS TO END OF SUCCESSIVE SEGS
C                 (EACH PASS LESS SEG)
C        TT - TRACK LENGTH
C         U - COMPONENT OF WIND VELOCITY IN DIRECTION OF TRACK SEGMENT
C        V1 - X-VELOCITY ALONG TRACK
C        V2 - Y-VELOCITY ALONG TRACK
C       VAR - VARIANCE USED
C       VEL - WIND VELOCITY (KNOTS)
C        VP - INTERPOLATED VELOCITY
C
C         W - WIND COMPONENT IN AIRCRAFT'S DIRECTION OF TRAVEL
C
C        X1 - X-COORD, TRACK DIRECTION
C
C        Y1 - Y-COORD, TRACK DIRECTION
C     SUBR - SUBROUTINE
C     PREPR DETERMINES THE VALUES OF OPERATIONAL PERFORMANCE PARAMETERS
C     (D,L,ALTITUDE, VELOCITY AND THRUST) OF A GIVEN FLIGHT AT A GIVEN
C     POINT.  WIND AND ALTITUDE EFFECTS ON AIRCRAFT PERFORMANCE ARE
C     CONSIDERED.
C     THE SUBROUTINE PREPR CALLS THE SUBROUTINES DELTA, GENFNT AND PROFDA.
C     PREPR HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS:
C     CALL PREPR (X2,D,DT,H,PWR,V,ITRC,NTRK,MAXSEG,IAPP)                  03-13-79
C     WHERE
C     X2 - PROFILE NUMBER FOR CURRENT FLIGHT
C     D - DISTANCE ALONG GROUND TRACK TO TRACKAS POINT OF CLOSEST APPROACH
C     OR TO POINT ON SECONDARY SEGMENT WHICH IS CLOSEST TO THE ANALYSIS
C     POINT
C     RT - RUNWAY LENGTH
C     H - AIRCRAFT ALTITUDE ABOVE GROUND LEVEL (COMPUTED BY PREPR)
C     PWR - AIRCRAFT THRUST SETTING (COMPUTED BY PREPR)
C     V - AIRCRAFT VELOCITY (COMPUTED BY PREPR)
C     ITRC - NOISE CURVE SET NUMBER ASSIGNED TO AIRCRAFT
C     NTRK - TRACK NUMBER
C     MAXSEG - TRACK SEGMENT NUMBER BEING CONSIDERED
C     THE SUBROUTINE EXPOSE IS THE ONLY USER OF PREPR AND WILL CALL IT
C     MANY TIMES DURING EXECUTION.
C     THE INPUT DATA TO PREPR IS PROVIDED BY THE CALLING ARGUMENTS AS WELL
C     AS LABELED COMMON BLOCKS WHOSE DESCRIPTORS FOLLOW.
C     COMMON BLOCK   VARIABLE  DESCRIPTION
C       /RUNWAY/       APA      AIRPORT ALTITUDE ABOVE MEAN SEA LEVEL.
C                      RWYL     RUNWAY LENGTHS.
C       /TRACK/        ITSEG    SEE
C                      MASK     DISCUSSION
C                      PARAM    IN
C                      TD       SUBROUTINE HBT.
C       /GROUP/        DCOM     COMMON DISTANCE FOR INDIVIDUAL GROUPS.
C                      ITRG     GROUP ASSIGNMENTS FOR EACH TRACK.
C       /WIND/         VEL      WIND VELOCITY (KNOTS) FOR EACH GROUP.
C                      DIR      WIND DIRECTION RELATIVE TO POSITIVE X-AXIS
C       /PROFIL/       PROF     AIRCRAFT PERFORMANCE PROFILES.
C       /RESALT/       VAR      NOISE ABATEMENT ALTERNATIVE FOR EACH TRACK
C                      STR      DISTANCE ALONG TRACK TO START OF PROCEDURE
C                      ENDR     DISTANCE ALONG TRACK TO END OF PROCEDURE.
C                      ICBNCH   ABATEMENT OVERRIDE COMMANDS.
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C                ENDALT    ALTITUDE ABOVE GROUND LEVEL AT END OF
C                          PROCEDURE.
C     THERE ARE TWO EXIT RETURNS FROM PREPR LOCATED AT LINES NUMBERED
C  82 AND 92 IN THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT
C  LINE 82 IS USED IF THE FLIGHT IS A TAKEOFF OR NO WIND CONDITIONS
C  EXIST FOR THE FLIGHT.  THE RETURN AT LINE 92 IS USED WHEN THE FLIGHT
C  BEING EXAMINED IS A LANDING AND WIND CONDITIONS ARE PRESENT.
C     THE OUTPUT FROM PREPR IS PROVIDED BY THE CALLING ARGUMENTS AS
C  WELL AS THE VARIABLE ASPROF IN LABELED COMMON BLOCK /PROFNI/ WHICH
C  IS A TEMPORARY STORAGE FOR THE EXPLICIT DEFINITION OF THE CURRENT
C  PERFORMANCE PROFILE AND WILL BE USED BY SUBROUTINE OVRLAY FOR ASDS
C  AND DOSE CALCULATIONS.  THE FOLLOWING PARAGRAPHS DISCUSS THE
C  PROCESSING PERFORMED BY PREPR.
C     BASICALLY, THE ALTITUDE IS FOUND BY LINEAR INTERPOLATION ON THE
C  DISTANCE ALONG THE TRACK IN THE PROFILE TABLES.  HOWEVER, THERE ARE
C  SOME MODIFICATIONS THAT CAN BE APPLIED TO TAKEOFFS.  FIRST, IF
C  THERE IS A WIND, THE AIRCRAFT PERFORMANCE RELATIVE TO THE GROUND
C  WILL CHANGE.  THIS MODIFICATION IS PERFORMED BY MULTIPLYING THE
C  DISTANCE FLOWN ALONG STRAIGHT TRACK SEGMENTS BY THE FACTOR
C            DELTA D = VA/(VA-V)
C  WHERE VA IS THE AIRCRAFT SPEED AND V IS THE COMPONENT OF THE WIND
C  SPEED ALONG TRACK SEGMENT.  NOTE THAT IF V > 0, THEN IT IS TAIL
C  WIND.  ALSO, IF THERE IS AN ABATEMENT ALTERNATIVE APPLICABLE TO THE
C  TRACK IN QUESTION, THIS MUST BE ACCOUNTED FOR AS THE FOLLOWING
C  PARAGRAPHS DESCRIBE.
C     WHEN A NOISE ABATEMENT ALTERNATIVE IS SPECIFIED, THE STANDARD
C  TAKEOFF PROCEDURES ARE MODIFIED BY INSERTING A PROFILE SEGMENT WHERE
C  THE THRUST AND CLIMB GRADIENT ARE AS SPECIFIED BY THE ABTEMENT
C  DEFINITION.  THE START AND ENDPOINTS OF THE ABATEMENT SEGMENT MUST
C  BE SPECIFIED BY THE USER AND MAY BE GIVEN AS EITHER AN ALTITUDE, IN
C  FEET, OR A DISTANCE ALONG THE TRACK FROM BRAKE RELEASE, IN NAUTICAL
C  MILES.  THE ONLY EXCEPTION TO THIS IS THAT IF THE ABATEMENT CLIMB
C  GRADIENT IS ZERO, THE ENDPOINT MUST BE SPECIFIED AS A DISTANCE FROM
C  BRAKE RELEASE.
C     THERE ARE FIVE DIFFERENT TYPES OF NOISE ABATEMENT ALTERNATIVES
C  ALLOWED FOR IN THE PROGRAM:
C        1.  ALTITUDE RESTRICTION (GAMMA = 0)
C        2.  TAKEOFF POWER
C        3.  MAXIMUM CLIMB POWER
C        4.  ENGINE OUT LEVEL FLIGHT POWER
C        5.  MAINTAIN SPECIFIED CLIMB GRADIENT (GAMMA)
C  WHERE THE "ENGINE OUT LEVEL FLIGHT" CUTBACK IS DEFINED BY:
C     T = THRUST REQUIRED FOR LEVEL FLIGHT WITH ONE ENGINE OUT,
C  AND
C     GAMMA = GRADIENT AT WHICH SPEED WILL BE CONSTANT WITH THE ABOVE
C  THRUST.
C  ABATEMENT TYPES 1 THROUGH 4 HAVE THE CLIMB GRADIENTS AND POWER
C  SETTINGS STORED IN THE AIRCRAFT TAKEOFF PROFILE.  THE TYPE 5 CUTBACK
C  REQUIRES SOME SPECIAL COMPUTATION.  SINCE THE GRADIENT IS INPUT AND
C  IS THE SAME FOR ALL AIRCRAFT TYPES, THE THRUST MUST BE COMPUTED.
C  THIS IS DONE BY:
C              T = (GAMMA*W/TEO*(N-1))/N
C        WHERE
C                  T IS THE CLIMB GRADIENT
C                  W IS THE GROSS WEIGHT OF THE AIRCRAFT
C                  TEO IS THE THRUST FOR ENGINE OUT LEVEL FLIGHT
C                  CUTBACK, AND
C                  N IS THE NUMBER OF ENGINES
C     TWO METHODS ARE USED TO INSERT THE ABATEMENT SEGMENT INTO THE
C  STANDARD PROFILE.  IF THE ABATEMENT PROCEDURE STARTS BEFORE THE
C  START OF THE FIFTH PROFILE SEGMENT, THEN, AFTER THE ABATEMENT
C  SEGMENT ENDS, THE AIRCRAFT REENTERS THE STANDARD PROFILE AT THE
C  START OF THE FOURTH SEGMENT.  NOTE THAT SINCE THIS PART OF THE
C  PROFILE IS DEFINED BASED ON AN ALTITUDE OF 1500 FEET AT THE START OF
C  THE FOURTH SEGMENT, PERFORMANCE FOR THE REMINDER OF THE PROFILE
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C  MUST AGAIN BE CORRECTED BY DELTA.
C    IF THE ABATEMENT PROCEDURE BEGINS DURING OR AFTER THE FIFTH
C  SEGMENT, THEN, AT THE END OF THE SEGMENT, THE AIRCRAFT RETURNS TO
C  THE STANDARD PROFILE AT THE POINT WHERE THE ABATEMENT PROCEDURE
C  STARTED.  ALSO, IT IS POSSIBLE TO SPECIFY OVERRIDE MODES FOR
C  SPECIFIC AIRCRAFT TYPES.  THESE ARE:
C       0 - ACCEPT ANY ABATEMENT ALTERNATIVE.
C       1 - NO ALTERNATIVE OF ANY TYPE.
C       2 - ENGINE CUT LEVEL FLIGHT ABATEMENT ONLY.
C       3 - TAKEOFF AND CLIMB ONLY.
C      LIKE THE ATTITUDE, THE THRUST IS DETERMINED BY INTERPOLATION IN
C  THE PROFILE TABLES, WITH THRUST TRANSITIONS SMOOTHED OVER 1000 FEET
C  OF GROUND TRACK DISTANCE.  SINCE NOISE IS CONSIDERED TO BE A
C  FUNCTION OF CORRECTED NET THRUST, A CORRECTION FOR PRESSURE ALTITUDE
C  FUNCTION OF CORRECTED NET THRUST, A CORRECTION FOR PRESSURE ALTITUDE
C  MUST BE MADE WHENEVER UNCORRECTED NET THRUST IS STORED IN OR
C  COMPUTED BY THE PROGRAM.  THIS IS THE CASE FOR THRUSTS STORED IN THE
C  APPROACH PROFILES USED FOR THE LEVEL FLIGHT AND NOISE ABATEMENT
C  THRUSTS STORED INTHE STANDARD TAKEOFF PROFILES.  (SEE DELTA
C  SUBROUTINE.)  AN ADDITIONAL MODIFICATION IS MADE TO SIMULATE THRUST
C  CHANGES FOR AN APPROACH WITH A WIND VECTOR.
C       W - AIRCRAFT WIGHT
C       GAMMA - CLIMB GRADIENT (NEGATIVE FOR DESCENT)
C       VW - WIND SPEED COMPONENT IN THE DIRECTION OF FLIGHT
C       VA - AIRCRAFT AIR SPEED
C       DELTA - PRESSURE ALTITUDE CORRECTION
C       E - NUMBER OF ENGINES
C     THE VELOCITY, LIKE THE THRUST, IS INTERPOLATED FROM THE PROFILE
C  TABLES, BUT WITH TWO POSSIBLE CORRECTIONS.  A WIND CORRECTION IS
C  APPLIED TO STRAIGHT TRACK SEGMENTS BY ADDING THE AIRCRAFT SPEED
C  AND THE COMPONENT OF THE WIND SPEED IN THE DIRECTION OF THE TRACK.
C  FOR CURVED SEGMENTS, IT IS APPLIED BY INTERPOLATING BETWEEN THE
C  CORRECTED VELOCITIES ON THE SURROUNDING TRACK SEGMENTS.  FOR
C  ABATEMENT ALTERNATIVES, THE VELOCITY IS ASSUMED TO BE CONSTANT
C  DURING THE PROCEDURE AND IS SET EQUAL TO THE VELOCITY AT THE START
C  OF THE ABATEMENT SEGMENT.  IN ORDER TO PREVENT AN EXCESSIVE
C  CORRECTION, THE VELOCITY IS NEVER PERMITTED TO BE LESS THAN 32
C  KNOTS.
C
```

Subroutine PROFDA

```
      SUBROUTINE PROFDA (NP,DD,RLL,H,PWR,V,ITAC,I,IAPP)                 03-13-79
C
C     GIVEN DISTANCE ALONG FLIGHT TRACK, PROFDA COMPUTES THE
C     AIRCRAFT HEIGHT, THRUST SETTING AND VELOCITY.
C     ***************************************************************************
C      LOCAL VARIABLE DICTIONARY
C      APPTHR - APPROACH THRUSTS (INPUT DATA FOR INTERPOLATION)
C      AY1 - THRUST SETTING AT START OF SEG
C      AY1 - THRUST SETTING AT END OF SEG
C     D - DISTANCE ALONG FLIGHT TRACK, CLOSEST POINT TO RUNWAY END
C     DD - DISTANCE ALONG TRACK
C     DT - DISTANCE ALONG TRACK
C     GTD - GROUND TRACK DISTANCE
C      GTDX - X COORD OF GROUND TRACK DISTANCE
C      H - HEIGHT ABOVE RUNWAY (INTERPOLATED)
C     I - ARRAY INDEX OF LARGEST ENTRY IN PROF LESS THAN DT
C     IAPP - APPROACH PARAMETER I.D. (ORDINAL)                          03-28-79
C     ITAC - A/C TYPE
C      JUNC - CONSTANT
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C     JOINT - NUMBER OF SEGMENT DATA POINTS
C      RK - CONSTANT
C     I - LOOK ARG FOR APPTHR KEYED TO ITAC
C      MATCH - TABLE OF INDEX ARGS TO APPTHR BY A/C TYPE
C     NP - PROFILE INDICATOR
C     NP - PROFILE NUMBER
C      PROF - PROFILE DATA (IN COMMON PROFIL)
C     PWR - RETURNS POWER SETTING
C     RL - RUNWAY LENGTH
C     RT - RUNWAY LENGTH
C     V - VELOCITY
C  2.47  PROFDA - SUBROUTINE
C        PROFDA IS USED BY SUBROUTINE PREPR TO DETERMINE THE ALTITUDE,
C  VELOCITY, AND THRUST FOR A GIVEN FLIGHT AT A GIVEN POINT.
C        PROFDA CALLS THE SUBROUTINES DELTA, POSNUT, PRCSET, AND GENFNI.
C        PROFDA HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS:
C            CALL PROFDA (NP,D,RT,H,PWR,V,ITAC,I,IAPP)                    03-13-79
C  WHERE
C        NP - PERFORMANCE PROFILE NUMBER
C        D - DISTANCE ALONG PROFILE TO ANALYSIS POINT
C        RT - RUN WAY LENGTH
C        H - ALTITUDE ABOVE GROUND LEVEL (RETURNED)
C        PWR - THRUST SETTING (RETURNED)
C        V - AIRCRAFT VELOCITY (RETURNED)
C        ITAC - AIRCRAFT ASSIGNED NOISE CURVE SET
C        I - NUMBER OF SEGMENTS IN PROFILE UP TO ANALYSIS POINT.
C     PREPR IS THE ONLY SUBROUTINE TO CALL PROFDA AND IT WILL DO SO
C  MANY TIMES DURING EXECUTION.
C     THE INPUT DATA TO PROFDA IS SUPPLIED BY THE CALLING ARGUMENTS AND
C  THE VARIABLES PROF, MATCH AND APPTHR IN LABELED COMMON BLOCK
C  /PROFIL/.
C     THERE ARE FOUR EXIT RETURNS FROM PROFDA, LOCATED AT LINES NUMBERED
C  52, 57, 59 AND 64 IN THE SUBROUTINE LISTING IN SECTION 5.  THE
C  RETURN AT LINE 52 IS USED WHEN THE ANALYSIS POINT IS BEYOND THE
C  STOPPING POINT FOR A LANDING.  THE RETURN AT LINE 57 IS USED AFTER
C  SMOOTHING THE THRUST FOR A TAKEOFF.  THE RETURN AT LINE 59 IS USED
C  IF NO SMOOTHING IS NECESSARY.  THE RETURN AT LINE 64 IS USED AFTER
C  SMOOTHING THE THRUST FOR A LANDING AND APPLYING ALTITUDE
C  CORRECTIONS.
C        THE OUTPUT FROM PROFDA IS CONTAINED IN THE CALLING ARGUMENTS.
C
C          GIVEN DISTANCE ALONG FLIGHT TRACK, PROFDA COMPUTES THE

C          AIRCRAFT HEIGHT, THRUST SETTING AND VELOCITY.

C             NP - PROFILE INDICATOR
C             D  - DISTANCE ALONG FLIGHT TRACK FROM CLOSEST POINT TO
C                  THE FAR END OF THE RUNWAY.
C             RL - RUNWAY LENGTH
```

Subroutine PROFRD

```
      SUBROUTINE PROFRD (IGO1,ICNT,IDUMP,MCDPRF)                    05-30-79
C
C     ******************************************************************
C      LOCAL VARIABLE DICTIONARY
C     A - DEFAULT AIRPORT ALTITUDE (0 FEET)
C      APALT - AIRPORT PRESSURE ALTITUDE
C      APTEMP - AIRPORT TEMP DEGREES KELVIN
C      CI - ALPHAMERIC OUTPUT LABEL
C     CT - DUMMY VARIABLE FOR OUTPUT LABEL
C     DUM - OUTPUT LABEL (/8H    /)
C     ET - OUTPUT LABEL (/ERRT/)
C      I - LOOP COUNTER
C     ICNT - PROFILE DATA (YES, REALLY!)
C      ICNT - DUMMY ARG
C      IDUMP - PASSED TO SETRES AS AN OUTPUT INDICATOR
C                 RETURNS AS ERROR INDICATOR
C     IFMT - MORE OUTPUT LABELS
C     IFM2 - MORE FORMAT INFO
C     IFMT - ARRAY CONTAINING FORMAT INFORMATION
C      IGO - ALTERNATE RETURN ADDRESS IN CALLING PROGRAM
C      IGO1 - ERROR RET RN ADDRESS IN CALLING PROGRAM
C     II - UNITS INDICATOR FOR PROFILE DATA
C      IPAR - OUTPUT LABEL ARRAY
C     IVAR - OUTPUT LABEL OF CURRENT LINE
C      J - LOOP COUNTER
C     K - PROFILE NUMBER
C      M - UPPER BOUND
C      PROF - A/C PERF PROFILES (SEE COMMON PROFILE)
C     T - DEFA    TPORT TEMPERATURE )2)) DEGREES KELVIN(
C      PROFRD        ATINE
C      PROFRD RE.    AIRCRAFT PERFORMANCE PROFILE INFORMATION FROM THE
C  INPUT DATA.
C      PROFRD CALLS THE SUBROUTINES MESAGE, MBETW, SETRES AND TPROF.
C      PROFRD HAS ONLY ONE ENTRY POINT AND THE CALLING SEQUENCE IS:
C          CALL PROFRD (*,ICNT,IDUMP)
C  WHERE
C        * - MEMORY LOCATION IN CALLING PROGRAM FOR ERROR RETURN.
C        ICNT - USED AS TEMPORARY STORAGE BY PROFRD.
C        IDUMP - PASSED TO SETRES AS AN OUTPUT INDICATOR AND PASSED
C  BACK FROM SETRES AS AN ERROR INDICATOR.
C        READING IS THE ONLY SUBROUTINE TO CALL PROFRD AND IT MAY BE
C  CALLED SEVERAL TIMES DURING THE INPUT PHASE OF EXECUTION.
C      THE INPUT DATA TO PROFRD IS PROVIDED BY INPT DATA CARDS FROM
C  THE BCD DECK.
C      THERE ARE TWO EXIT RETURNS FROM PROFRD, LOCATED AT LINES
C  NUMBERED 77 AND 78 IN THE SUBROUTINE LISTING IN SECTION 5.  THE
C  RETURN AT LINE 77 IS AN ERROR RETURN WHILE THE ONE AT LINE 78 IS
C  USED UNDER NORMAL CONDITIONS.
C      THE OUTPUT FROM PROFRD CONSIST OF INFORMATION STORED IN THE
C  AIRCRAFT PERFORMANCE PROFILE TABLE PROF IN LABELED COMMON BLOCK
C  /PROFIL/.
C    THE PROCESSING PERFORMED BY PROFRD IS TO READ AND STORE
C  PERFORMANCE PROFILES FROM THE PUT DATA.  THE INPUT DISTANCES ARE
C  CONVERTED TO FEET FROM NAUTICAL MILES IF NECESSARRY.  EXTENSIVE
C  ERROR CHECKS ARE MADE ON THE INPUT DATA.
C
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Subroutine PROSET

```
      SUBROUTINE PROSET (NP,ITAC,KK,IAPP)                                03-15-79
C
C     ***************************************************************************
C
C     SUBSTITUTES PROFILE PARAMETERS INTO APPROACH PROFILES
C     AS INDICATED BY NEGATIVE NUMBERS STORED IN PROF
C
C     PARAMETERS WILL BE PLACED INTO PROFILE 100
C      LOCAL VARIABLE DICTIONARY
C      APPTHR - A/C POWER SETTINGS
C      ASPROF - ASDS PROFILE INFO - VELOCITY AND THRUSTS
C      IAPP - APPROACH PARAMETER I.D. (ORDINAL)                          03-29-79
C      ITAC - NOISE CURVE NUMBER ASSIGNED TO CURRENT A/C
C     ITYPP - APPROACH PROFILE LOOKUP ARG )AIRCRAFT TYPE(
C      KK - ONE GREATER THAN THE NUMBER OF PROFILE SEGMENTS
C      MATCH - TABLE OF ITYPE
C     NSEGS - NUMBER OF SEGMENTS
C     PR - PROFILE RESTRICTIONS )ASPROF(
C      PROF - A/C PERFORMANCE PROFILES
C     STR - START RANGE
C     TOTL - TRACK LENGTH INCLUDING RUNWAY
C      PROSET - SUBROUTINE
C      PROSET IS USED BY SUBROUTINE PROFDA TO INITIALIZE LANDING
C PERFORMANCE DATA WHEN "INDICATORS" ARE USED IN THE DEFINITIONS.
C      PROSET DOES NOT USE ANY EXTERNAL SUBROUTINES.
C      PROSET HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS:
C          CALL PROSET (NP,ITAC,KK,IAPP)                                 03-13-79
C WHERE
C        NP - PROFILE NUMBER.
C       ITAC - NOISE CURVE SET NUMBER ASSIGNED TO THE CURRENT AIRCRAFT.
C        KK - THE NUMBER OF PROFILE SEGMENTS +1.
C      PROFDA IS THE ONLY SUBROUTINE TO CALL PROSET.
C      THE INPUT TO PROSET IS PROVIDED BY THE CALLING ARGUMENTS AND
C THE TABLES PROF AND APPTHR IN THE LABELED COMMON BLOCK/PROFIL/.
C      THERE IS ONE EXIT RETURN FROM PROSET, LOCATED AT LINE NUMBER
C 3[illegible] IN THE SUBROUTINE LISTING IN SECTION 5 AND IT IS USED UNDER
C ALL CONDITIONS.
C      THE OUTPUT FROM PROSET CONSISTS OF THE CONTENTS OF THE VELOCITY
C AND THRUST VALUES IN PERFORMANCE PROFILE NUMBER 100 IN THE VARIABLE
C PROF AS WELL AS THE SAME VALUE FOR THE VARIABLE ASPROF IN LABELED
C COMMON BLOCK/PROFIL/.
C      THE PROCESSING PERFORMED BY PROSET CONSITS OF RETRIEVING
C VARIABLES FROM THE ARRAY APPTHR AS INDICATED BY THE PROFILE
C ENDER ANALYSIS AND STORING THOSE VARIABLES APPROPRIATELY INTO
C WORKING LOCATIONS.
C
C     SUBSTITUTES PROFILE PARAMETERS INTO APPROACH PROFILES
C       AS INDICATED BY NEGATIVE NUMBERS STORED IN PROF
C        PARAMETERS WILL BE PLACED INTO PROFILE 100
```

Function PWR4ME

```
      FUNCTION PWR4ME (AX,AY,AZ)
C
C     ****************************************************************
C      THE FUNCTION PWR4E RETURNS AS ITS VALUE THE CORRECT QUOTE APPROXIMATION
C                  TO QUOTE TO A PRODUCT REQUIRED BY AL (SEE BELOW)
C
```

Subroutine READIN

```
      SUBROUTINE READIN (NRW)
C
C     ****************************************************************
C      LOCAL VARIABLE DICTIONARY
C      FAC - FLAG TO CLEAR RUNWAY UTILIZATION TABLES
C      I - LOOP COUNTER
C      ICNT - USER COMMENT
C      NCNT - NUMBER OF ERRORS
C      ICODE - DATA INPUT CONTROL CODE (SEE BELOW)
C      IDUMP - ERROR FLAG
C      IGO - ALTERNATE RETURN ADDRESS IF CALLING PROGRAM
C    READIN - SUBROUTINE
C    THE SUBROUTINE READIN CONTROLS THE READING OF INPUT DATA FROM
C  CARDS.
C    READIN CALLS THE FOLLOWING SUBROUTINES:
C    ACTPDT  ASDCOM  NEPSRD  NEWMIX  PWYRD
C    ATCPRD  ASDOTH  MESAGE  NOISRD  TOWRD
C    APDTRD  ASDOTH  MIXRD  PCNTRD  TRAKRD
C    ASDANC  GROPRD  NRETW  PROPRD  WINDRD
C    READIN HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS:
C      CALL READIN (NRW)
C  WHERE:
C      NRW - NUMBER OF RUNWAYS DEFINED AT THIS TIME.  ERROR RETURN IF
C  NRW = 0 AFTER CALL IN CALLING PROGRAM.
C    THE MAIN PROGRAM NOISEI IS THE ONLY PROGRAM TO CALL READIN.
C    THE INPUT TO READIN CONSIS ENTIRELY OF DATA CONTROL CARDS READ
C  FROM THE INPUT DECK.
C    THERE ARE TWO EXIT RETURNS FROM READIN, LOCATED AT LINES 29 AND
C  119 IN THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT LINE 29
C  IS THE NORMAL RETURN WHILE THE ONE AT LINE 119 IS USED IF ERRORS
C  ARE ENCOUNTERED.
C    THE OUTPUT FROM READING CONSIST ONLY OF PRINTED ERROR MESSAGES.
C    THE OUTPUT FROM READIN CONSISTS ONLY OF PRINTED ERROR MESSAGES.
C
      EXTERNAL NRETW
C
CODE 000      RETURN TO NOISE*
CODE 100-1    READ RUNWAYS AND TRACKS
CODE 100-2    READ TRACKS ONLY          (MUST FOLLOW RUNWAY DATA)
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CODE 100-3     READ MIX DATA
CODE 100-4     READ TRACK PERCENTAGES (THEN MIX DATA)
CODE 100-5     READ MIX DATA - FIXED PROPORTION FORMAT
CODE 101       READ PROFILES
CODE 102       READ NOISE CURVES
CODE 103       READ TRACK ALTITUDE RESTRICTIONS
CODE 104       READ NOISE CURVE MERGE DATA    (MUST FOLLOW MIX DATA)
CODE 105       READ TRACK GROUP DATA     (MUST PRECEED MIX DATA)
CODE 106       READ WIND DATA
CODE 107       READ NEW AIRCRAFT DEFINITIONS
CODE 108       READ APPROACH PARAMETERS
CODE 109       READ TOLERANCES
CODE 110        READ ASDS 2 THRESHOLD.
CODE 111        READ ASDS 3 THRESHOLDS AND TIMES.
CODE 112        READ AIRCRAFT NOISE CONSTANTS FOR ASDS.
CODE 113        READ OPERATIONAL CONSTANTS FOR ASDS.
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Subroutine RWYRD

```
      SUBROUTINE RWYRD(I301,NRW,FAC,IDUMP)
C
C     ********************************************************************
C      LOCAL VARIABLE DICTIONARY
C      A - RADIUS, CURVED SEGMENT
C     APT - ORIGINAL AIRPORT ALTITUDE )FROM APALT(
C     AMR - TABLE OF RUNWAY NAMES_1 ' DEPARTURE, 2 ' ARRIVAL
C      APALT - AIRPORT ALTITUDE ABOVE MEAN SEA LEVEL
C      APTEMP - AVERAGE AMBIENT AIRPORT TEMPERATURE DEGREES KELVIN
C      BDF - ACTUAL RUNWAY DATA (NUMBER, BRAKE RELEASE, END ,ETC)
C      CTHETA - CUMULATIVE TURN ANGLE (MUST BE LESS THAN 270 DEGREES)
C      DMIN - LENGTH OF SHORTEST STRAIGHT SEG OR ONE HALF RADIUS OF
C                  MIN TURN, WHICHEVER SMALLEST
C      DUM - DUMMY VARIABLE, SILLY
C      FAC - DUMMY ARG TO RWYRD (NOT USED, PERIOD)
C      IDUMP - DIAGNOSTIC OUTPUT INDICATOR
C      I30 - ERROR RETURN
C      I301 - HERE ANOTHER ERROR RETURN INDICATOR
C     IDBIG - NUMBER OF BUSIEST RUNWAY
C     IRWY - RUNWAY NUMBER
C      ITR - RUNWAY NUMBER ASSIGNED TO EACH TRACK
C      ITSEG - NUMBER OF SEGMENTS IN A GIVEN TRACK IN LOW 5 BITS
C     ITOTNX -
C      I    - SEGMENT NUMBER PASSED IN SUBROUTINE CALLS
C      MASK - DECODING CONSTANTS FOR ITSEG
C     MRW - RUNWAY ERROR FLAG )RUNWAY = OUT OF BOUNDS - DEPARTURE(
C     MAR - RUNWAY ERROR FLAG )RUNWAY = OUT OF BOUNDS - ARRIVAL(
C     NAMR - TABLE OF RUNWAY NAMES, AS AMR
C      NRW - NUMBER OF DEFINED RUNWAYS (RETURNED)
C     NRWY - RUNWAY NUMBER
C      NS - NUMBER OF SEGMENTS
C      NT - TRACK NUMBER
C      NTRWY - RUNWAY NUMBER FOR GIVEN TRACK
C     NWR - NUMBER OF RUNWAYS
C      PARAM - TRACK SEGMENT INFORMATION (SEE HBT)
C      RL - RUNWAY LENGTHS (FEET)
C      RW - W*1/2
C     RUSE - NUMBER OF RESTRICTED OPERATIONS )DEPARTURES, ARRIVALS(
C     PER RUNWAY PER DAY/EVENING/ NIGHT
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C      SI - SIGN (SO CALLED) OF TURN (RIGHT OR LEFT HAND)
C     TEMP - ORIGINAL AIRPORT TEMPERATURE )FROM APTEMP(
C     BOTH ALT AND TEMP ARE AS BEFORE MODIFIED BY THIS ROUTINE
C      THETA - TURN ANGLE, CURVED SEGMENT
C      TTD - TRACK DISTANCES FROM START OF RUNWAY TO END OF SUCCESSIVE SEGMENTS
C      FOR ALL EXCEPT LAST SEGMENT (GUESS WHY)
C      UNIT - UNIT VECTOR, DIRECTION OF RUNWAY
C     V1 - VECTOR BRAKE RELEASE POINT TO RUNWAY END )DEPARTURE(
C     V2 - VECTOR BRAKE RELEASE POINT TO RUNWAY END )ARRIVAL(
C      XA - RUNWAY START COORDS
C      XD - RUNWAY END COORDS
C      XL - DISTANCE TO BEGINNING OF TRACK SEGMENT
C      XLONG - LENGTH OF TAKEOFF SEGMENT
C      XR1 - VECTOR, ORIGIN TO RUNWAY END
C    RWYRD - SUBROUTINE
C    SUBROUTINE RWYRD READS THE AIRPORT ALTITUDE AND MEAN AMBIENT
C  TEMPERATURE AS WELL AS RUNWAY DEFINITIONS FROM THE INPT DATA.
C    RWYRD CALLS THE SUBROUTINES TRADRD (ALTERNATE ENTRY IN RWYRD),
C  SETRES, MESAGE, NBETW, TPROF, VSUB AND VMAG.
C    RWYRD HAS TWO ENTRY POINTS, RWYRD AND TRAKRD.  THE CALLING
C  SEQUENCE FOR RWYRD IS AS FOLLOWS:
C        CALL RWYRD(*,NRW,FAC,IDUMP)
C  WHERE
C
C        * - MEMORY LOCATION IN CALLING PROGRAM FOR ERROR RETURN.
C
C      NRW - NUMBER OF DEFINED RUNWAYS (RETURNED)
C
C      FAC - NOT USED.
C
C      IDUMP - DIAGNOSTIC OUTPUT INDICATION PASSED TO SUBROUTINES
C  TRAKRD AND SETRES.
C      READIN IS THE ONLY SUBROUTINE TO CALL RWYRD AND IT WILL NORMALLY
C  ONLY BE CALLED ONCE PER RUN.
C    THE INPUT TO RWYRD IS SUPPLIED ENTIRELY FROM DATA CARDS IN THE
C  INPUT RUN DECK.
C    THERE ARE NO EXIT RETURNS FROM RWYRD AND ALL RETURNS ARE EXECUTED
C  IN TRAKRD.
C  TRAKRD IS THE NATURAL CONTINUATION WHEN RWYRD IS COMPLETE SINCEIT IS
C  ASSUMED THAT IF A RUNWAY IS DEFINED, THERE ARE TRACKS TO GO WITH IT
C  AND THEY CAN BE EFFICIENTLY DEFINED NOW.
C    THE OUTPUT FROM RWYRD CONSISTS OF THE NUMBER OF DEFINED RUNWAYS,
C  NEW, OF COURSE, AS WELL AS THE INITIALIZATION OF VARIABLES IN THE
C  LABELED COMMON BLOCKS /RUNWAY/AND/RWYUTL/.  THE VARIABLES IN THOSE
C  BLOCKS ARE DESCRIBED AS FOLLOWS:
C      COMMON
C      BLOCK  VARIABLE  DESCRIPTION
C      /RUNWAY/  APALT  AIRPORT ALTITUDE ABOVE MEAN SEA LEVLE.
C      /RUNWAY/  APALT  AIRPORT ALTITUDE ABOVE MEAN SEA LEVLE.
C                APTEMP  AVERAGE AMBIENT TEMPERATURE AT AIRPORT (K)
C                XA      RUNWAY START COORDINATES.
C                XD      RUNWAY END COORDINATES.
C                RL      RUNWAY LENGTHS (FEET).
C      /RWYUTL/  ANR     RUNWAY NAMES, THREE CHARACTERS EACH.
C                INRWY   NUMBER OF DEFINED RUNWAYS.
C      RWYRD PERFORMS NO FURTHER PROCESSING AFTER INITIALIZING THE
C  ABOVE TABLES BUT PROCEEDS IMMEDIATELY TO TRAKRD TO READ GROUND
C  TRACK INFORMATION.
C    TRAKRD IS AN ALTERNATE ENTRY IN RWYRD.
C    TRAKRD CALLS THE SUBROUTINES MESAGE, NBETW, DGTRD, HELG, VUNT AND
C  XLINE.
C    THE CALLING SEQUENCE FOR TRAKRD IS:
C      CALL TRAKRD(*,IDUMP)
C  WHERE
C      * - MEMORY LOCATION IN CALLING PROGRAM FOR ERROR RETURN.
C    IDUMP - DIAGNOSTIC OUTPUT INDICATOR WHICH, IF NOT EQUAL TO ZERO,
```

```
C  CAUSES THE CONTENTS OF THE VARIABLE PARAM IN LABELED COMMON BLOCK
C  /TRACK/TO BE OUTPUT TO THE PRINTER FOR ALL DEFINED GROUND TRACKS.
C  (SEE SUBROUTINE HBT FOR A DISCUSSION OF PARAM.)
C    TRAKRD IS CALLED FROM READIN AND, BY DEFAULT, FROM RWYRD.
C    THE INPUT FOR TRAKRD COMES FROM INPUT DATA CARDS, THE VARIABLES
C  RT, XA AND XD IN COMMON BLOCK /RUNWAY/ AND THE VARIABLE MASK IN
C  LABELED COMMON BLOCK /TRACK/.
C    THERE ARE TWO EXIT RETURNS FROM TRAKRD (AND RWYRD) 8 LOCATED AT
C  LINES NUMBERED 163 AND 164 IN THE SUBROUTINE LISTING IN SECTION 5.
C  THE RETURN AT LINE 163 IS AN ERROR RETURN WHILE THE ONE AT LINE 164
C  IS USED IF NO ERRORS ARE ENCOUNTERED.
C    THE OUTPUT FROM TRAKRD CONSISTS OF INITIALIZED VARIABLES IN THE
C  LABELED COMMON BLOCK /TRACK/ DEFINED AS FOLLOWS.
C    VARIABLE   DESCRIPTION
C    ITR      -  RUNWAY NUMBER ASSIGNED TO EACH TRACK.
C    ITSEG    -  (SEE SUBROUTINE HBT FOR DESCRIPTION.)
C    PARAM    -  (SEE SUBROUTINE HBT FOR DESCRIPTION.)



C    ITTD     -  TOTAL TRACK DISTRANCE, RUNWAY INCLUDED, TO THE END
C  OF ALL BUT THE LAST SEGMENT FOR EACH DEFINED TRACK.  DISTANCE IS IN
C  FEET.
C    DMIN     -  FOR EACH TRACK, THE LENGTH OF THE SHORTEST STRAIGHT
C  SEGMENT OR ONE-HALF THE MINIMUM TURN RADIUS, WHICHEVER IS SMALLEST.
C    THE PROCESSING PERFORMED BY TRADKRD CONSISTS OF THE COMPUTATION OF
C  THE VALUES FOR THE INITIALIZED VARIABLES, EXCEPT PARAM.  TRAKRD WILL
C  CALL XLINE TO PROCESS STRAIGHT SEGEMENTS AND HELG FOR TURN SEGMENTS
C  AND THESE TWO SUBROUTINES PERFORM THE INITIALIZATION IN PARAM.
C
```

Subroutine SETRES

```
      SUBROUTINE SETRES (*P,*P,IDUMP)

C

C     ********************************************************************

C      LOCAL VARIABLE DICTIONARY
C      APALT - PRESSURE ALTITUDE CORRECTION FROM DELTA
C     AX - PROFILE TABLE FOR GENF1 INTERPOLATION
C     AXX - START OF RESTRICTION ZONE FOR PARTICULAR RUNWAY + PROFILE
C     BX - PROFILE TABLE FOR GENF1 INTERPOLATION
C     DELT - RATIO OF POWER SETTING TO THAT REQUIRED FOR FINAL
C     PROFILE ALTITUDE
C     END - END OF RESTRICTION ZONE
C      ENDALT - ALTITUDE AT END OF PROCEDURE FOR EACH PROF AND RESTR NUMBER
C      ENDR - RESTRICTION END
C    GCRN    - INPUT TAKEOFF GRADIENT FOR EACH RESTRICTION NUMBER.
C    ICRT    - TYPE OF ABATEMENT PROCEDURE FOR EACH RESTRICTION NUMBER.
C    ICSNCO  - PROCEDURE OVERRIDE CODES FOR EACH NOISE CURVE SET.
C     IDUMP - FLAG TO DUMP VARIABLES TO IPT IF SETRES FAILS
C      IGO - ERROR RETURN
C      II - CONTAINS POSITION IN TABLE OF LAST VALUE NOT GREATER THAN XX
C     INT - LOOP COUNTER )NUMBER OF VALUES IN AX,BX(
C      NAP   - NOISE ABATEMENT PROCEDURE NUMBER FOR EACH TRACK.
C  PROFILE AND RESTRICTION NUMBER.
```

```
C     NP - NUMBER OF PROFILES TOWHICH RESTRICTIONS APPLY
C     NR - RUNWAY NUMBER TO WHICH RESTRICTIONS APPLY
C     NRT - RESTRICTION TYPE
C    ORGEND  - INPUT PROCEDURE END DEFINITION.
C    ORGSTR  - INPUT PROCEDURE START DEFINITION.
C      PROF - TABLE OF PROFILE INFORMATION
C     PWR - POWER SETTING TO MAINTAIN SPECIFIED GRADIENT
C     STALT - ALTITUDE AT START OF RESTRICTION
C    STR*    - DISTANCE FROM THRESHOLD TO START OF PROCEDURE FOR EACH
C PROFILE AND RESTRICTION NUMBER.
C     STRT - START OF RESTRICTION ZONE
C     Z - ALTITUDE AT WHICH PN1 EXCEEDS CLIMB POWER
C    SETRES - SUBROUTINE
C    SUBROUTINE SETRES INITIALIZES APPROPRIATE VARIABLES WHEN THE
C OPTIONAL TAKEOFF PROCEDURES ARE REQUESTED.
C    THE SUBROUTINE SETRES CALLS THE SUBROUTINE MESAGE IF AN ERROR IS
C ENCOUNTERED AND GENFN1 TO DO INTERPOLATIONS.
C    THERE IS ONE ENTRY IN SETRES AND THE CALLING SEQUENCE IS:
C      CALL SETRES (NP, NR, IDUMP)
C WHERE
C     NP  PERFORMANCE PROFILE NUMBER.
C     NP   RESTRICTION NUMBER INDEFINITION TABLES.
C     IDUMP  DIAGNOSTIC OUTPUT INDICATOR WHICH IF NOT EQUAL TO ZERO
C CAUSES THE RESULTS TO BE PRINTED.  ON RETRUN INDICATES ERROR IF = -1
C    SETRES IS CALLED BY THE SUBROUTINES ALTRRD, PROFRD AND RWYRD.
C    THE INPUT DATA FOR SETRES IS PROVIDED BY THE CALLING ARGUMENTS AND
C THE LABELED COMMON BLOCK /RESALT/.  THE FOLLOWING IS A DESCRIPTION
C OF THE VARIABLES IN /RESALT/.
C    VARIABLE  DESCRIPTION
C NAR       - NOISE ABATEMENT PROCEDURE NUMBER FOR EACH TRACK.
C    ENDR*    - DISTANCE FROM THRESHOLD TO END OF PROCEDURE FOR EACH
C PROFILE AND RESTRICTION NUMBER.
C    STR*     - DISTANCE FROM THRESHOLD TO START OF PROCEDURE FOR EACH
C PROFILE AND RESTRICTION NUMBER.
C    ICBT     - TYPE OF ABATEMENT PROCEDURE FOR EACH RESTRICTION NUMBER.
C    GCRN     - INPUT TAKEOFF GRADIENT FOR EACH RESTRICTION NUMBER.
C    ICBNCO   - PROCEDURE OVERRIDE CODES FOR EACH NOISE CURVE SET.
C    ENDALT* - ALTITUDE AT END OF PROCEDURE FOR EACH PROFILE AND
C RESTRICTION NUMBER.
C    ORGSTR   - INPUT PROCEDURE START DEFINITION.
C    ORGEND   - INPUT PROCEDURE END DEFINITION.
C *THESE VARIABLES ARE INITIALIZED BY SEYRES.
C    THERE ARE SIX EXIT RETURNS FROM SETRES, LOCATED AT LINES NUMBERED
C 9, 11, 14, 32, 65 AND 70 IN THE SUBROUTINE LISTING IN SECTION 5.
C THE RETURN AT LINE 9 IS USED IF THE PROFILE NUMBER IS GREEATER THAN
C 85.  THIS IS NOT AN ERROR.  THE RETURN AT LINE 11 IS USED IF THE
C PROFILE HAS NOT BEEN DEFINED.  THE RETURN AT LINE 14 IS USED IF NO
C PROCEDURE HAS BEEN ASSIGNED TO THE RESTRICTION NUMBER NR.  THE
C RETURN AT LINE 32 IS AN ERROR RETURN AND IS USED IF THE PERFORMANCE
C PROFILE IS NOT IN STANDARD FORM.  THE RETURN AT LINE 65 IS THE
C NORMAL RETURN USED AFTER PROCESSING IS COMPLETE.  THE RETURN AT LINE
C 70 IS USED AFTER COMPLETION OF PROCESSING AND PRINTING DIAGNOSTIC
C OUTPUT.
C    THE OUTPUT FROM SETRES IS AS INDICATED BY THE ASTERISKS IN THE
C PREVIOUS DISCUSSION OF THE VARIABLES IN THE LABELED COMMON BLOCK
C /RESALT/.
```

Function SGNI (I)

This function returns the value $\pm$ 1 according to the following:

SGNI = 1 for I $\geq$ 0
SGNI = -1 for I < 0

Function SGNR

```
      FUNCTION SGNR (R)
C
C     ******************************************************************

C     SGNR - FUNCTION SUBROUTINE
C     SGNR RETURNS THE VALUE +1. ACCORDING TO THE FOLLOWING:

C     SGNR = X/ABS(X)   FOR X=0
C       SGNR = +1.   FOR X=0
C     SGNR DOES NOT USE ANY SUBROUTINES.
C     THERE IS ONE ENTRY TO SGNR AND THE CALLING SEQUENCE IS:
C       SGNR (R)
C   WHERE
C       R - ANY REAL NUMBER.
C     SGNR IS CALLED BY THE SUBROUTINES NEWPNT AND CURVE.
C     THE INPUT TO SGNR IS THE CALLING ARGUMENT.
C     THERE IS ONE EXIT RETURN FROM SGNR AND IS ALWAYS USED.
C     THE OUTPUT FROM SGNR IS + 1 OR - 1 AS PREVIOUSLY DESCRIBED.
```

Subroutine SIFT

```
      SUBROUTINE SIFT (TABN,NF,NSF,TN,SN,TOLL)
C
C     ******************************************************************
C      LOCAL VARIABLE DICTIONARY
C      ITPRAC - A TABLE CONTAINING UP TO 2000 DISTINCT FLIGHT IDENTIF
C                 CATION CODES (SEE MIXRD)
C      IVX - DUMMY UNIT NUMBER
C      J - COUNTER
C     MSK1 - ENCODING MASK FOR ITPRAC
C     MSK2 - ENCODING MASK FOR ITPRAC
C     NF' TOTAL = OF FLIGHTS
C      NOPS - TOTAL OPERATIONS BY ETC
C     NSF' = OF SIGNIFICANT FLIGHTS
C     SIGM - SIGNIFICANCE MEASURE )10**2.5(/TOI
C     SN' NOISE FROM SIGNIFICANT FLIGHTS ONLY
C     SUM - TOTAL NOISE FROM _SIGNIFICANT_ FLIGHTS )63G VALUE(
C     TABN CONTAINS NOISE DATA
C     TN' TOTAL NOISE
C     TOLL - TOLERANCE APPLIED TO EXPOSURE SUM TO DETERMINE
C     _SIGNIFICANT_FLIGHTS
C     TOT - TOTAL _SIGNIFICANT_ NOISE
C     XTIM - TOLERANCE APPLIED TO EACH ENTRY IN TABN
C     SIFT - SUBROUTINE
C     SIFT DETERMINES WHICH FLIGHTS ARE TO BE USED WHEN SEARCHING FOR
C   THE NEXT POINT ON THE CONTOUR.  THE NOISE FROM FLIGHT OPERATIONS IS
C   SUMMED IN ORDER OF SIGNIFICANCE UNTIL THE SUM IS WITHIN A TOLERANCE
C   OF THE TOTAL FOR ALL FLIGHTS AND ONLY THE FLIGHTS WHOSE NOISE VALUES
C   WERE INCLUDED IN THE SUM (I.E., THE MOST SIGNIFICANT FLIGHTS) ARE
C   USED.
C     THE SUBROUTINE SIFT DOES NOT USE EXTERNAL SUBROUTINES.
C     SIFT HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS :
C       CALL SIFT (TABN,NF,NSF,TN,SN,TOI)
C   WHERE
C     TABN - TABLE OF NOISE VALUES WHICH WERE COMPUTED FOR EACH DEFINED
```

```
C  FLIGHT THE LAST TIME THE NOISE AT A POINT WAS COMPUTED.
C     NF - TOTAL NUMBER OF DEFINED FLIGHTS.
C     NSF - NUMBER OF SIGNIFICANT FLIGHTS (RETURNED).
C     TN - SUMMATION OF NOISE VALUES INCLUDING THE CONTRIBUTIONS
C  FROM ALL DEFINED FLIGHTS (I.E., SUMMATION OF VALUES IN TABLE TABN).
C     SN - SUMMATION OF NOISE VALUES FROM SIGNIFICANT FLIGHTS
C  (RETURNED).
C     TOL - ALLOWABLE TOLERANCE IN CONTOUR LEVEL.
C     EXPOSE IS THE ONLY SUBROUTINE TO CALL SIFT AND IT WILL DO SO MANY
C  TIMES DURING EXECUTION.
C     THE INPUT DATA TO SIFT IS PROVIDED THROUGH THE CALLING ARGUMENTS.
C     THERE ARE TWO EXIT RETURNS FROM SIFT, LOCATED AT LINES NUMBERED
C  30 AND 81 IN THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT
C  LINE 30 IS USED AFTER THE PROCESSING FOR SIGNIFICANT FLIGHTS HAS
C  BEEN COMPLETED.  THE RETURN AT LINE 81 IS USED WHEN THE NUMBER
C  OF DEFINED FLIGHTS IS 50 OR LESS, IN WHICH CASE ALL FLIGHTS WILL BE
C  USED ALL THE TIME.
C     THE OUTPUT OF SIFT CONSISTS OF THE MODIFICATION OF THE TABLE
C  ITPRAC IN LABELED COMMON BLOCK/TRAFIK/ (SEE SUBROUTINE MIXRD FOR
C  DESCRIPTION OF THE CONTENTS OF ITPRAC).  SPECIFICALLY, FOR EACH
C  SIGNIFICANT FLIGHT DEFINED IN ITPRAC, THE MOST SIGNIFICANT BINARY
C  BIT IN THE DEFINITION WORD WILL BE A 1 AND FOR THE INSIGNIFICANT
C  FLIGHTS IT WILL BE A 0.
C     ALL ADDITIONAL OUTPUT IS PASSED THROUGH THE CALLING ARGUMENTS AS
C  PREVIOUSLY DEFINED.
C     THE PROCESSING PERFORMED BY SIFT CONSISTS OF DETERMINING WHICH
C  FLIGHTS OF THE TOTAL CREATE A SIGNIFICANT ENOUGH CONTRIBUTION TO
C  THE OVERALL NOISE EXPOSURE AND SHOULD BE INCLUDED IN THE SEARCH FOR

C  THE NEXT POINT.  SINCE THE COMPUTATION OF NOISE FROM ANY FLIGHT,
C  SIGNIFICANT OR NOT, TAKES THE SAME AMOUNT OF TIME AND EFFORT, THE
C  ELIMINATION OF AS MANY FLIGHTS AS POSSIBLE FROM THE COMPUTATIONS

C  WILL SIGNIFICANTLY REDUCE THE RUN TIME OF THE PROGRAM.

C     THE NOISE DATA FOR THE FLIGHT CONTRIBUTIONS AND SUMMATIONS
C  IS COMPUTED AND STORED IN ANTILOG FORM AND CONVERTED TO DECIBELS
C  ONLY WHEN NECESSARY TO LIMIT CALLS TO MATHEMATICAL FUNCTION ALOG10
C  AND RAISING 10 TO A REAL POWER.  THIS ALSO SAVES TIME.
C     A FLIGHT IS DETERMINED SIGNIFICANT IF THE FOLLOWING CONDITION
C  HOLDS:
C     TABN(I).GE.TOT/SIGM
C  WHERE
C  TABN(I) IS THE NOISE CONTRIBUTION OF FLIGHT I IN ANTILOG FORM
C     TOT = 10**((TN-TOL)/ 10)
C     SIGM = 10**(2.5*ALOG(TOL))
C     TN= SUMMATION OF NOISE FROM ALL FLIGHTS (DECIBELS).
C     TOL = ALLOWABLE CONTOUR LEVEL ERROR TOLERANCE (DECIBELS).
C  IF THE SUM OF ALL SIGNIFICANT FLIGHTS' NOISE CONTRIBUTIONS IS LESS
C  THAN TOT,
C  THEN SIGM IS MULTIPLIED BY 2.0 AND THE PROCESS IS REPEATED.
C  REPETITION CONTINUES UNTIL THE ABOVE IS NOT TRUE.
C     IF ANY REPETITION(S) IS NECESSARY, THE CHARACTERS SFTXX WILL BE
C  PRINTED ON THE CONTOUR OUTPUT AT THE FAR RIGHT SIDE, WHERE XX IS THE
C  NUMBER OF REPETITIONS.
```

Subroutine SKFIL

```
      SUBROUTINE SKFIL (IU,N,ISTAT)

C     SKIPER-SUBROUTINE

C     THE SUBROUTINE SKIPER IS USED TO SKIP FILES (ENTRY SKFIL) OR

C  RECORDS (ENTRY SKREC) ON MAGNETIC TAPE.
C     SKIPER HAS TWO ENTRY POINTS AT SKFIL AND SKREC.  THE CALLING
C  SEQUENCE FOR SKFIL IS:
C        CALL SKFIL (LU,N,LSTAT)
C  WHERE
C     IU  FORTRAN LOGICAL UNIT NUMBER
C     N  NUMBER OF FILES TO BE SKIPPED
C          +N = SKIP FORWARD,
C          -N = SKIP BACKWARD,
C           0 = SKIP TO BEGINNING OF CURRENT FILE.
C     LSTAT  STATUS OF COMPLETED OPERATION
C             0 = NORMAL COMPLETION
C             1 = BAD OR INAPPROPRIATE UNIT
C             2 = NOT USED
C             3 = UNRECOVERABLE ERROR
C     SKFIL IS CALLED BY THE SUBROUTINES POSIT AND PPGRM.
C     THE INPUT TO SKFIL IS THROUGH THE CALLING ARGUMENTS.
C     THE OUTPUT FROM SKFIL IS, LIKEWISE, PASSED THROUGH THE CALLING
C  ARGUMENTS.
C     THE SECOND ENTRY SKREC HAS THE CALLING SEQUENCE:
C       CALL SKREC (LU,N,LSTAT)
C  WHERE
C     LU  FORTRAN LOGICAL UNIT NUMBER
C      N  NUMBER OF PHSICAL RECORDS TO SKIP
C         +N = SKIP FORWARD
C         -N = SKIP BACKWARD
C          0 = NO OPERATION
C     ISTAT  STATUS OF COMPLETED OPERATION
C             0 = NORMAL COMPLETION
C             1 = BAD OR INAPPROPRIATE UNIT
C             2 = END -OF -FILE OR LOAD POINT PASSED
C             3 = UNRECOVERABLE ERROR
C     SKREC IS NOT USED BY THE CONTOUR ANALYSIS MODEL BUT IS USED BY THE
C  CONTOUR PLOTTING PACKAGE.
```

Subroutine SKREC (IU, N, ISTAT)

Subroutine SKREC foward/backward skips logical records. See Subroutine SKFIL for a complete description:

Subroutine SORTI (AIRCRFT, N)

Subroutine SORTI is a general purpose subroutine used to sort one dimensional ARRAYS. This subroutine examines the input ARRAY, AIRCRFT, removes zero and duplicate entries, and sorts the table in ascending order. Input variable, N, is the number of entries in ARRAY AIRCRFT. This subroutine is used primarily bu subroutine LOAD.

Subroutine SORT2

```
      SUBROUTINE SORT2 (IT,Z,Y,IK)
C
C     ******************************************************************
C
C     SORTS IT IN ASCENDING ORDER
C     SORTS Z AND Y ACCORDING TO IT
C     ENTRY SORT2 DOES NOT BOTHER TO SORT Y
C     IK - NUMBER OF ELEMENTS IN ARRAYS
C      IL - LOGICAL FLAG (TRUE OR FALSE)
C     XX - TEMPORARY STORAGE FOR VALUES MOVED
```

Subroutine SORT4

```
      SUBROUTINE SORT4 (IT,A,B,C,D,IK,N)
C
C     ******************************************************************
C     IK - LENGTH OF ARRAYS
C     IT, A,B,C,D - ARBITRARY ARRAYS
C     THIS ROUTINE SORTS THEM IN ASCENDING ORDER
C     ACCORDING TO IT
C     N - EXTRA ARGUMENT (NOT USED!)
C  SORT4 - SUBROUTINE
C  SORT4 IS A NUMERICAL SORTING ROUTINE THAT ARRANGES THE VALUES IN A
C  GIVEN TABLE IN DESCENDING ORDER.  CORRESPONDING VALUES IN FOUR
C  ASSOCIATED TABLES ARE REARRANGED IN THE SAME FASHION AS THE GIVEN
C  TABLE WITHOUT REGARD TO THEIR QUANTITATIVE ORDER.  THIS ROUTINE IS
C  USED TO ASSEMBLE THE FLIGHT IDENTIFICATION TABLE AND THE ASSOCIATED
C  EQUIVALENT OPERATIONS FOR NRF, IDN, CNEJ, AND LFQ INTO LOGICAL
C  ORDER.  NOTE THAT THE OPERATIONS FOR ASDS AND DOSR ARE THE SAME AS
C  FOR LFQ.
```

```
C  SORT? DOES NOT USE ANY EXTERNAL SUBROUTINES.
C  SORT? HAS ONLY ONE ENTRY POINT AND THE CALLING SEQUENCE IS
C  CAL' SORT?(IT,A,B,C,D,IK,M)
C  WHERE
C  IT - THE TABLE TO BE SORTED
C  A,B,C,D - THE FOUR TABLES TO SORT THE SAME WAY AS IT
C  IK - NUMBER OF VALUES IN THE TABLES
C  M - NOT PRESENTLY USED BY SORT?
C  SORT? IS CALLED BY THE SUBROUTINES MIXRD, MERGRD, AND NEWMIX.
C  THE INPUT DATA FOR SORT? IS PROVIDED BY THE CALLING ARGUMENTS.
C  THERE ARE TWO EXIT RETURNS FROM SORT?, LOCATED AT LINES NUMBERED 4
C  AND 9? IN THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT LINE 4
C  IS USED IF THERE ARE LESS THAN THREE VALUES IN THE TABLES AND THE
C  RETURN AT LINE 9? IS USED OTHERWISE.
C  THE OUTPUT OF SORT? IS THROUGH THE CALLING VARIABLES.  THE TABLE IT
C  WILL BE SORTED SO THAT THE VALUES ARE IN DESCENDING ORDER.  THE
C  TABLES A,B,C,D WILL BE SORTED IN THE SAME ORDER AS TABLE IT WITHOUT
C  REGARD TO NUMERICAL ORDER.
C
```

Subroutine STRAIT

```
      SUBROUTINE STRAIT (IGO,RO,P,D,X,IE)
C
C     ********************************************************************
C     COMPUTES DISTANCE FROM A POINT )RO TO  )
C     IRO? IF MAXSEG IS KNOWN
C     P)1(,P)2( ARE COORDINATES OF THE SEGMENT START
C     P)3( IS THE SEGMENT LENGTH
C     P)4(,P)5( IS A UNIT VECTOR ALONG THE SEGMENT
C     D - VECTOR MAGNITUDE
C     S - DIFFERENCE VECTOR BETWEEN PO AND SEGMENT START POINT
C     X - PROJECTION OF DIFFERENCE VECTOR ONTO TRACK SEGMENT
C      RO - COORDINATES OF POINT IN QUESTION
C      IGO - ERROR RETURN
C  STRAIT - SUBROUTINE
C  SUBROUTINE STRAIT COMPUTES THE DISTANCE FROM A GIVEN POINT TO A
C  STRAIGHT LINE SEGMENT OF A TRACK.
C  STRAIT CALLS THE SUBROUTINES VADD, VSCL, VDOT, VMAG, AND VSUB.
C  STRAIT HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS
C  CALL STRAIT(*,RO,P,D,X,IE)
C  WHERE
C  * - MEMORY LOCATION IN THE CALLING PROGRAM FOR RETURN WHEN POINT IS
C  NOT IN THE RANGE OF THE LINE SEGMENT.
C  RO - THE COORDINATES OF THE POINT IN QUESTION
C  P - VARIABLE OF DIMENSION 5 OR MORE WHICH CONTAINS THE FOLLOWING THE
C  FIRST FIVE POSITIONS
C  P(1)=X-COORDINATE OF SEGMENT START
C  P(2)=Y-COORDINATE OF SEGMENT START
C  P(3)=SEGMENT LENGTH (FEET)
C  P(4)=X-COMPONENT OF UNIT VECTOR ALONG SEGMENT
C  P(5)=Y-COMPONENT OF UNIT VECTOR ALONG SEGMENT
C  D - DISTANCE TO SEGMENT (RETURNED)
C  X - DISTANCE ALONG SEGMENT (RETURNED)
C  IE - INDICATOR WHICH IF NOT EQUAL TO ZERO MEANS THAT IT IS KNOWN
C  THAT THE POINT IS IN THE SEGMENT RANGE
C  HRT IS THE ONLY SUBROUTINE TO CALL STRAIT.
```

```
C  THE INPUT TO STRAIT IS PROVIDED BY THE CALLING ARGUMENTS.
C  THERE ARE TWO EXIT RETURNS FROM STRAIT AT LINES NUMBERED 11 AND 16
C  IN THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT LINE 11 IS AN
C  ALTERNATE RETURN USED WHEN THE POINT RO IS OUTSIDE THE RANGE OF THE
C  LINE SEGMENT.  THE RETURN AT LINE 16 IS USED WHEN THE POINT IS
C  WITHIN THE RANGE OF THE LINE SEGMENT.
C  THE OUTPUT FROM STRAIT IS THROUGH THE CALLING ARGUMENTS AS
C  PREVIOUSLY DEFINED.
C
```

Subroutine SWITCH

```
      SUBROUTINE SWITCH (A,B)
C
C     ******************************************************************
C       THIS ROUTINE EXCHANGES THE VALUES OF TWO VARIABLES
C                  BY A SIMPLE CIRCULAR SUBSTITUTION
C
      ---- ---
```

Subroutine TIHISI

```
      SUBROUTINE TIHISI(IG*,DIST1,DIST2,SCENO)

C     ******************************************************************

C      LOCAL VARIABLE DICTIONARY

C      A - CURRENTLY SELECTED EXPOSURE THRESHOLD

C       ADL  - ABSOLUTE VALUE OF THE LAST NOISE LEVEL DIFFERENCE
C       ADT - ABSOLUTE VALUE OF DT
C       ALA - A LEVEL EXPOSURE FOR PREVIOUS TIME STEP (ALOBSO)
C       ALB - A LEVEL EXPOSURE FOR CURRENT TIME STEP (ALOBS)
C      ALDB - DUMMY VAR FOR INTERNAL FUNCTION DECLARATION (LINE 42)
C       ALOBS - TABLE OF A LEVEL (EXPOSURES AT NTH) OBSERVERS  (MOMENTARY)
C       ALOBSI - KEEPS TRACK OF UNCORRECTED VALUE OF ALOBS FOR CURRENT
C                  TIME STEP
C       ALOBSO - ALOBSI OF PREVIOUS TIME STEP (0 FOR OLD)
C      ATH- ARRAY OF UP TO 20 THRESHOLD LEVELS IN DB FOR WHICH
C      EXCEEDENCE TIMES WILL BE CALCULATED
C       ALX - DUMMY VAR FOR INTERNAL FUNCTION DECLARATION (LINE 42)
C       ALY - DUMMY VAR FOR INTERNAL FUNCTION DECLARATION (LINE 42)
C      ASDST-  ARRAY FOR UP TO 20 THRESHOLD LEVELS AND UP TO 20 OBSERVERS
C       CONTAINING THE THRESHOLD LEVEL EXCEEDENCE TIMES FOR EACH OBSERVER
C      IN SECONDS
C      AVD- MAGNITUDE OF VECTOR V COMPUTED BY AI
C       AVDMIN - SMALLEST AVD (VECTOR MAGNITUDE) YET ENCOUNTERED
C       B- ACCELERATION THROUGH THE CURRENT SEGMENT
C      BACKGR- BACKGROUND NOISE LEVEL IN ENERGY EQUIVALENT UNITS
C      TO WHERE AIRCRAFT TRACKING IS TO START
C       CDT - TIME STEP TOLERANCE (DCL/TSSC**2 OR DCL/2, WHICHEVER IS LARGER)
C       CHDT - CDT/10, A TENTH OF CDT
C       CHDT2 - CHDT/TSSC, IE DCL/10*TSSC**3 OR DCL/20*TSSC
C       D- DISTANCE ALONG THE GROUND TRACK, FROM THE BEGINNING,
C       DATRK- DISTANCE IN FEET OF CLOSEST APPROACH TO THE FIRST OBSERVER
C      MEASURED ALONG THE GROUND TRACK STARTING AT THE THRESHOLD OF THE RUNWAY
C       WHICH WOULD BE USED IF IT WERE A TAKEOFF TRACK.  NEGATIVE DATRK
C      INDICATES THE POINT OF CLOSEST APPROACH TO THE FIRST OBSERVER IS THE START
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C      POINT OF THE TRACK.
C      DDMAX' - 'OWEST THRESHOLD LEVEL ('INE 45F)
C      DCL- 'SED IN DETERMINING THE NEXT TIME INCREMENT, BASED ON THE
C     CURRENT TIME INCREMENT AND THE CHANGE IN NOISE LEVEL OVER THE
C     'AST STEP.  DT'DT*DCL/ADL
C     DFTH- DIFFERENCE BETWEEN INITIAL THRUST (FTH) AND THE THRUST OF
C     PRECEDING SEGMENT (FLITEP(5,KSEG-1)).
C      DFTHMX- MAXIMUM 'LLOWABLE THRUST CHANGE OVER THE NEXT TIME STEP.
C     DINT-  INITIAL TIME INCREMENT IN SECONDS. DMINT.LE.DINT.LE.DMAXT
C     DIST1- DISTANCES IN FEET FROM RUNWAY THRESHOLD ALONG GROUND TRACK
C      INDICATING FROM WHERE TO WHERE THE AIRCRAFT WAS TRACKED
C      DIST1I - DIST1 OF PREVIOUS SEGMENT
C     DIST2- DISTANCES IN FEET FROM RUNWAY THRESHOLD ALONG GROUND TRACK
C     INDICATING FROM WHERE TO WHERE THE AIRCRAFT WAS TRACKED.
C      DIST2I - DIST2 OF PREVIOUS SEGMENT
C     DL- 'AST NOISE 'EVEL DIFFERENCE (PREVIOUS TIME STEP)
C      DL0 - NOISE LEVEL DIFFERENCE TWO STEPS PREVIOUS (STEP BEFORE DL)
C     DMAXT- THE LARGEST ALLOWABLE TIME STEP SIZE IN SECONDS
C     DMINT- THE SMALLEST 'LLOWABLE TIME STEP SIZE IN SECONDS
C     DT- THE NEXT TIME INCREMENT
C     DTLC- 'AST CALCULATED DT
C     DUR- TIME NECESSARY TO FLY THROUGH THE CURRENT SEGMENT
C     DW- DUMMY FOR OVRLAY(W) ANDPOSCOO(W) HORIZONTAL DISTANCE ALONG
C     CURRENT SEGMENT, IN FEET, FROM THE BEGINNING OF THE SEGMENT TO THE
C     'NALYSIS POSITION
C     DXISI- MAXIMUM 'LLOWABLE ANGLE CHANGE (DECK AND BANKING)
C     ENERGY- CONTAINS ACCUMULATED ENERGY NOISE LEVELS FOR EACH OBSERVER
C      FOR THIS ONE FLYBY, AFTER THE TIHISI CALL.
C     FLITEP- CONTAINS THE SEGMENTED SPECIFICATION OF THE FLIGHT PATH.
C     FP- THRUST
C     FSIFKN- CONVERSION FACTOR, KNOTS TO FEET PER SECOND
C     FTH- DUMMY FOR 'L(F),THRUST SETTING OF THE AIRCRAFT
C      FTHOLD - OLD FTH, PREVIOUS TIME STEP
C     I- INDEX VARIABLE
C     IGO- ERROR BRANCH IN CASE OF A RETURN1 FROM TIHISI
C     IGO1- MEMORY LOCATION IN CALLING PROGRAM FOR ERROR RETURN
C     I- AIRCRAFT NUMBER
C     JF- TIME DIRECTION IN RELATION TO PCA SEGMENT
C     JP- AIRCRAFT NUMBER
C     K- STEP COUNTER FOR CURRENT SEGMENT
C     KK- NUMBER OF POINTS IN THE TIME HISTORY
C     KSEG- THE NUMBER OF THE SEGMENT BEING ANALYZED IN THE FLIGHT PATH
C     DEFINITION
C      KSUP - COUNTS NUMBER OF TIME STEPS
C     KTRAK- GROUND TRACK NUMBER
C     L- IMPLICIT LOGICAL- ALL VARIABLES BEGINNING WITH L CONTAIN L'GICAL
C     'SSIGNMENTS
C      'A - IS ALA GT A
C      'B - IS A'B GT A
C      'A - AT 'EAST ONE OBSERVER NOISE LEVEL ABOVE LOWEST THRESHOLD
C      'CHECK - HAVE TIHISI CHECK ARGS IN CALLING SEQ AND ASDSBL
C      'DET' - PROVIDE DETAILED DIAGNOSTIC OUTPUT
C      'DMIN' - IS 'DT 'ESS THAN OR EQUAL DMINT
C      'ENRGY - CALCULATE 'CCUMULATED ENERGY NOISE LEVELS
C      'HALF - 'AS DT BEEN HALVED IN THE PRECEEDING TIME STEP
C      'INIT - ARE WE AT THE FIRST POINT IN A SEGMENT OF THE FLIGHTPATH
C      'JP1 - DO WE NEED SEGMENTS FOLLOWING THE POINT OF CLOSEST APPROACH SEGMEN
C      'JP2 - MUST WE TROUBLE OURSELVES WITH SEGMENTS PRECEEDING THE PCA SEG
C      'KSUP - ARE WE FINISHED (FOR NOW) WITH THE TIME PROGRESSION IN THIS DIR
C      'RDST - FORGET REMAINING EXCEEDANCE TIMES, THEY ARE ALL BELOW THRESHOLD
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C      ITM - THE TIME LIMIT HASN'T BEEN REACHED YET
C      IXISI - IS THIS THE FIRST CALL TO POSCCC FOR THIS FLIGHT
C      M- INDEX VARIABLE> ERROR INDICATOR NUMBER
C      MNPLP-USED FOR DUMPING IN CASE AN ERROR IS DETECTED
C      MNPS- USED FOR DUMPING IN CASE AN ERROR IS DETECTED
C      MNTS- USED FOR DUMPING IN CASE AN ERROR IS DETECTED
C      N- INDEX VARIABLE
C      NAC- USED FOR DUMPING IN CASE AN ERROR IS DETECTED
C      NBIN- USED FOR DUMPING IN CASE AN ERROR IS DETECTED
C      NFS- DUMMY FOR OVRLAY(KPS),NUMBER OF FLIGHT PATH SEGMENTS ASSEMBLED BY
C      OVRLAY
C      NOBS- NUMBER OF OBSERVERS
C      NPCAS- NUMBER OF THE FLIGHT PATH SEGMENT TO START AIRCRAFT TRACKING
C      NPTP- THE NUMBER OF TIME STEPS UP TO WHICHTHE RESULTS OF EACH STEP
C     ARE STORED IN ARRAYS TGPL, ALPL, AND COORD.
C      NPS- NUMBER OF PROFILE SEGMENTS
C      NSM- USED FOR DUMPING IN CASE AN ERROR IS DETECTED
C      NSTEP- MAXIMUM ALLOWABLE NUMBER OF TIME STEPS IN ANY ONE SEGMENT
C      NTH- NUMBER OF THRESHOLD LEVELS
C     NTS- NUMBER OF TRACK SEGMENTS
C      OMEGA- ANGULAR VELOCITY IN RADIANS PER SECONDS WITH WHICH THE
C      AIRPLANE IS ALLOWED TO CHANGE ITS NOSEUP AND BANKING ANGLES
C       O - SWAPPING ARRAY TO SIMPLIFY SWITCHING OF VARS AT PROGRESSION REVERSAL
C                 (SEE LINE 19 AND PREVIOUS LINES)
C       OI - 0 FROM PREVIOUS STEP, ETC
C      SDMETC- A GIVEN DISTANCE IN FEET WHICH , IF EXCEEDEDAT ANY TIME
C       BY THE AIRCRAFT TO OBSERVER DISTANCE, CAUSES THE TRACKING PROCESS

C      TO TERMINATE

C      STOC- SPEED WHEN CROSSING A SEGMENT BOUNDARY

C      T- TIME WHEN THE AIRCRAFT IS EXACTLY AT THE SEGMENT BOUNDARY
C      TL- <1. FOR TAKEOFF, -1. FOR LANDING
C       TIAMAX - MOST SUBSEQUENT TIME STEP TO BE CONSIDERED IN CURRENT SEG
C       TIAMIN - MOST PREVIOUS  TIME STEP TO BE CONSIDERED IN CURRENT SEG
C      TMAX- THE LARGEST ALLOWABLE REAL-TIME IN SECONDS
C      TMIN- THE SMALLEST ALLOWABLE REAL-TIME IN SECONDS
C      TOTALT- ARRAY FOR UP TO 20 OBSERVERS CONTAINING THE TOTAL TIMES
C      OVER WHICH CALCULATIONS HAVE BEEN PERFORMED BY TIHISI.
C       TPDT - CURRENT TIME STEP (QUESTION MARK)
C       TSDI - TIME STEP TOLERANCE (DCL*TSSC)
C       TSDL4 - A LARGER TIME STEP TOLERANCE (DCL*TSSC**4)
C      TSSC- USED TO CONTROL THE TIME STEP BY CHECKING THAT ADL IS SMALLER
C      THAN DCL*TSSC.  THE LARGER TSSC, THE GREATER JUMPS IN NOISE LEVEL
C      ARE ALLOWED, THE POORER THE RESOLUTION
C       U - SCRATCH VAR USED TO COMPUTE VARIOUS DIFFERENCES, AS LINE 312
C      V- VECTOR FROM THE FIXED COORDINATE ORIGIN TO THE AIRPLANE
C      VALPHA, VBETA, VGAMMA ARE UNIT VECTORS POINTING IN THE DIRECTIONS
C      OF THE THREE AXES OF THE COORDINATE SYSTEM FIXED WITH THE AIRPLANE
C      VD- AN ARRAY OF VECTORS, EACH VECTOR POINTING FROM THE AIRPLANE TO ONE
C       OBSERVER,WITH RESPECT TO THE AIRPORT FIXED COORDINATE SYSTEM
C      VDP- SAME AS VD, EXCEPT VECTOR COMPONENTS ARE WITH RESPECT TO
C           AIRPLANE FIXED COORDINATE SYSTEM
C      VO- ARRAY OF UP TO 20 VECTORS EACH POINTING TO ONE OBSERVER
C      W- LENGTH OF THE SEGMENT (MEASURED IN THE GROUND PLANE)
C
C  TIHISI - SUBROUTINE
C  SUBROUTINE TIHISI IS CALLED DURING ASDS OR DOSE CALCULATIONS TO
C  PROVIDE THE TIMES THAT SELECTED THRESHOLD NOISE LEVELS ARE EXCEEDED
C  BY ONE FLIGHT.  TO THIS END, A TIME HISTORY SIMULATION (HENCE, THE
C  NAME OF THE SUBROUTINE) IS PERFORMED BY TRACKING THE AIRCRAFT ON ITS
C  USER GROUND TRACK GEOMETRY AND AIRCRAFT PERFORMANCE INFORMATION.
C  THE TRACKING IS DONE IN DISCRETE TIME STEPS OF VARYING LENGTH.
C  TIHISI CALL SEVERAL EXTERNAL SUBROUTINES:
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C  OVRLAY - OVERLAYS THE PERFORMANCE PROFILE OVER THE GROUND TRACK,
C  DETERMINES FLIGHT PATH SEGMENTS.  CALLED IN LINE 57 (SEE LISTINGS,
C  SECTION 5).
C  POSCOO - DETERMINES THE POSITION COORDINATES OF THE AIRCRAFT AND THE
C  AIRPLANE FIXED COORDINATE SYSTEM, BOTH WITH RESPECT TO THE AIRPORT
C  FIXED COORDINATE SYSTEM.  CALLED IN LINE 190.
C  EGA - CALCULATES EXTRA GROUND ATTENUATION (LINE 220).
C  AL - CALCULATES THE NOISE LEVEL AT THE ANALYSIS POINT FOR THE
C  CURRENT AIRCRAFT POSITION AND ORIENTATION (LINE 223).
C  TIHISI HAS ONE ENTRY POINT ONLY AND THE CALLING SEQUENCE IS:
C  CALL TIHISI (*,DIST1,DIST2,SCMENO)
C  WHERE
C  * - TO BE REPLACED IN AN ACTUAL CALL BY A STATEMENT LABEL TO WHICH
C  TO BRANCH IN CASE OF A RETURN 1 FROM TIHISI.  THIS FEATURE IS USED
C  IN CASE TIHISI DETECTS AN ERROR.
C  DIST1,DIST2 - CALCULATED BY TIHISI; DISTANCES IN FEET FROM RUNWAY
C  THRESHOLD ALONG GROUND TRACK INDICATING FROM WHERE TO WHERE THE
C  AIRCRAFT WAS TRACKED.
C  SCMENO - VALUE TO BE SUPPLIED WHEN CALLING TIHISI.  IT IS A GIVEN
C  DISTANCE IN FEET WHICH, IF EXCEEDED AT ANY TIME BY THE AIRCRAFT TO
C  OBSERVER DISTANCE, CAUSES THE TRACKING PROCESS TO TERMINATE.
C  PRESUMABLY, SCMENO IS CHOSEN SUCH THAT THE RESULTING NOISE LEVEL
C  WOULD BE LOWER THAN ANY REASONABLE LOWEST THRESHOLD LEVEL.  SCMENO
C  DEPENDS ON AIRCRAFT TYPE.  USED ONLY ONCE IN LINE 232.
C  TIHISI IS CALLED BY SUBROUTINES ASDS2 AND ASDS3.  IN ADDITION TO THE
C  CALLING SEQUENCE, TIHISI COMMUNICATES VIA MANY COMMON BLOCKS:
C  /THBLOK/ - CONTAINS A CONGLOMERATE OF VARIABLES WHICH MUST ALL HAVE
C  SPECIFIED VALUES WHEN TIHISI IS CALLED:
C  KTRAK:  THE TRACK NUMBER
C  NTS:  THE NUMBER OF TRACK SEGMENTS
C  NPS:  THE NUMBER OF PROFILE SEGMENTS
C  NOBS:  THE NUMBER OF OBSERVERS
C  J:  AIRCRAFT NUMBER (SEE ARGUMENT J IN FUNCTION SUBROUTINE AL)
C  ISTEP:  MAXIMUM ALLOWABLE NUMBER OF TIME STEPS IN ANY ONE SEGMENT
C  NTH:  NUMBER THRESHOLD LEVELS
C  DATRK:  DISTANCE IN FEET OF POINT OF CLOSEST APPROACH TO THE FIRST
C  OBSERVER, MEASURED ALONG THE GROUND TRACK STARTING AT THE THRESHOLD
C  OF THE RUNWAY WHICH WOULD BE USED IF IT WERE A TAKEOFF TRACK.  DATRK
C  MUST NOT BE LONGER THAN THE TRACK ITSELF.  A NEGATIVE DATRK
C  INDICATES THAT THE POINT OF CLOSEST APPROACH TO THE FIRST OBSERVER
C  IS THE START POINT OF THE TRACK.  IF DATRK IS NEGATIVE, IT NEED NOT
C  BE THE ACTUAL DISTANCE TO THE START POINT.
C  TL:  +1. FOR TAKEOFF. -1. FOR LANDING.
C  LCHECK:  TRUE IF YOU WISH TIHISI TO CHECK ON THE REASONABLENESS OF
C  THE ARGUMENTS IN THE CALLING SEQUENCE AND SOME OF THE PARAMETERS IN
C  COMMON BLOCK ASDSBL.  FALSE OTHERWISE.
C  LDET:  TRUE, IF YOU WISH DETAILED DIAGNOSTIC OUTPUT FOR EACH TIME
C  STEP.  FALSE, OTHERWISE.
C  VO:  VO(3,20) IS AN ARRAY OF UP TO 20 VECTORS EACH POINTING TO ONE
C  OBSERVER.  IF N IS THE OBSERVER NUMBER, THEN VO(1,N) IS THE X-COORD-
C  INATE, VO(2,N) THE Y-COORDINATE, AND VO(3,N), THE ALTITUDE, ALL IN
C  FEET.  YOU MUST, OF COURSE, PROVIDE NOBS VECTORS.  NOTE THAT IF THE
C  ALTITUDE IS GREATER THAN 10 FEET, NO EXTRA GROUND ATTENUATION IS
C  SUBTRACTED FROM THE AIRCRAFT NOISE LEVEL FOR THAT OBSERVER.
C  NPLP:  THE NUMBER OF TIME STEPS UP TO WHICH THE RESULTS OF EACH STEP
C  ARE STORED IN ARRAYS TGPL, ALPI, AND COORD, I.E., THE ACTUAL NOISE
C  LEVEL TIME HISTORY AND AIRCRAFT POSITION AND DIRECTION ARE DEPOSITED
C  THERE.  THIS HAS BEEN BUILT PRIMARILY FOR THE PURPOSE OF PLOTTING
C  THE TIME HISTORIES FOR EACH OBSERVER, BUT MAY BE USED OTHERWISE.  IF
C  NPLP IS LESS THAN OR EQUAL TO ZERO, ARRAYS TGPL AND ALPI ARE NOT
C  FILLED.  NPLP MUST NOT BE GREATER THAN 400.  IF THE ACTUAL NUMBER OF
C  TIMES STEPS EXCEEDS NPLP, TIHISI CONSIDERS THIS AN ERROR.  THE
C  ARRAYS TGPL, ALPI, AND COORD ARE ON COMMON BLOCK /PLOTDI/ (SEE
C  BELOW).
C  LENERGY:  IF ACCUMULATED ENERGY NOISE LEVELS ARE TO BE CALCULATED,
C  THIS IS TRUE.  FALSE OTHERWISE.
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C  BACKGR:  THE BACKGROUND NOISE LEVEL IN ENERGY EQUIVALENT UNITS.
C  NOISE LEVEL NEVER DROPS BELOW IT.  EXAMPLE: IF BACKGROUND LEVEL IS
C  75 DB, THEN BACKGR=10.**(75/10)=3.162278
C  /ASDSV/ - CONTAINS VARIABLES AND ARRAYS RELATING TO THE TRACKING
C  ALGORITHM AND ASDS CALCULATIONS.  ALL BUT THE LAST THREE MUST HAVE
C  SPECIFIED VALUES WHEN TIHISI IS CALLED.  THE LAST THREE ARE
C  CALCULATED BY TIHISI (TOTALT, ASDST, ENERGY).  ALL VARIABLES ARE
C  REAL.
C  ASPROF:  THIS PROFILE IS GENERATED IF SUBROUTINE PREPR AND IS THE
C  PERFORMANCE PROFILE FOR THE AIRCRAFT TYPE IN THE CURRENT FLIGHT
C  BEING ANALYZED.  TIHISI MODIFIES ASPROF.  WHETHER IT IS A LANDING OR
C  A TAKEOFF PROFILE, DISTANCES ARE ALWAYS MEASURED IN FEET FROM THE
C  RUNWAY THRESHOLD WHICH WOULD BE THE THRESHOLD IF IT WERE A TAKEOFF
C  TRACK.
C  DCL:  USED IN DETERMINING THE SIZE OF THE NEXT TIME INCREMENT, BASED
C  ON THE CURRENT TIME INCREMENT AND THE CHANGE IN NOISE LEVEL OVER THE
C  LAST STEP: WIZ

C  DT = DT*DCL/ADI
C  WHERE ADI IS THE ABSOLUTE VALUE OF THE LAST NOISE LEVEL DIFFERENCE.

C  DCL IS USUALLY CHOSEN BETWEEN 1 AND 5 DB.  THE SMALLER DCL, THE MORE
C  ACCURATE THE RESOLUTION, THE LARGER THE COMPUTING TIME.

C  TSSC:  USED TO CONTROL THE TIME STEP BY CHECKING THAT ADI IS SMALLER
C  THAN DCL*TSSC.  SHOULD ADI BE GREATER, THEN THE TIME STEP IS HALVED.
C  TSSC IS USUALLY CHOSEN BETWEEN 1.2 AND 3.  IT MUST NOT BE LESS OR
C  EQUAL TO 1.  THE LARGER TSSC, THE GREATER JUMPS IN NOISE LEVEL ARE
C  ALLOWED, THE POORER THE RESOLUTION.  NOTE THAT IT WORKS IN
C  CONJUNCTION WITH DCL.
C  DINT:  THE INITIAL TIME INCREMENT IN SECONDS.
C  NOTE:
C  SMINT.LE.DINT.LE.DMAXT
C  DMINT:  THE SMALLEST ALLOWABLE TIME STEP SIZE, SECONDS.
C  DMAXT:  THE LARGEST ALLOWABLE TIME STEP SIZE, SECONDS.
C  TMIN:  THE SMALLEST ALLOWABLE REAL-TIME, SECONDS.
C  TMAX:  THE LARGEST ALLOWABLE REAL-TIME, SECONDS.
C  OMEGA:  THE ANGULAR VELOCITY IN RADIANS PER SECOND WITH WHICH THE
C  AIRPLANE IS ALLOWED TO CHANGE IT NOSE-UP AND BANKING ANGLES.
C  ALTH:  ARRAY OF UP TO 20 THRESHOLD LEVELS IN DB FOR WHICH EXCEEDENCE
C  TIMES WILL BE CALCULATED.  THE ACTUAL NUMBER OF LEVELS USED IS
C  INDICATED BY NTH IN COMMON BLOCK/THBLOK/.
C  TOTALT:  FOR EACH OF UP TO 20 OBSERVERS, THE TOTAL TIMES OVER WHICH
C  CALCULATIONS HAVE BEEN PERFORMED BY TIHISI ARE ACCUMULATED IN THIS
C  ARRAY.  THESE TIMES WILL BE LONGER THAN THE EXCEEDENCE TIME ABOVE
C  THE LOWEST THRESHOLD LEVEL BECAUSE TIHISI CALCULATES AN EXTRA 5
C  POINTS BELOW THE LOWEST THRESHOLD LEVEL IN AN ATTEMPT TO MAKE SURE
C  THAT THE NOISE LEVEL DOES NOT COME UP AGAIN.
C  ASDST:  ARRAY FOR UP TO 20 THRESHOLD LEVELS AND UP TO 20 OBSERVERS,
C  CONTAINING THE THRESHOLD LEVEL EXCEEDENCE TIMES FOR EACH OBSERVER IN
C  SECONDS.
C  ENERGY:  AN ARRAY FOR UP TO 20 OBSERVERS IN WHICH THE NOISE ENERGY
C  ABOVE THE LOWEST THRESHOLD LEVEL IS ACCUMULATED IF LENRGY IS .TRUE.
C  (SEE THBLOK ABOVE).  THE RESULT IN ENERGY AFTER THE TIHISI CALL ARE
C  THE ACCUMULATED ENERGY NOISELEVELS FOR EACH OBSERVER FOR THIS ONE
C  FLYBY.  NOTE THAT ENERGY IS SET TO ZERO AT THE START OF EACH TIHISI
C  CALL.
C  /PLOTB/ - TIHISI FILLS THIS ARRAY IF NPLP IS POSITIVE (SEE/THBLOK/)
C  KK:  NUMBER OF POINTS IN THE TIME HISTORY:
C  0.LE.KK.LE.NPLP
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C  TGPL:  TGPL(402,20) CONTAINS FOR UP TO 400 POINTS AND UP TO 20
C  OBSERVERS THE SOUND ARRIVAL TIMES IN SECONDS.  THE EXTRA TWO WORDS
C  ABOVE 400 ARE PROVIDED FOR PLOT SCALING PARAMETERS.
C  ALPL:  ALPL(402,20) CONTAINS FOR UP TO 400 POINTS AND UP TO 20
C  OBSERVERS THE A-WEIGHTED NOISE LEVELS IN DB, CORRESPONDING TO THE
C  SOUND ARRIVAL TIMES IN TGPL.
C  COORD:  COORD(102,3) CONTAINS FOR UP TO 400 POINTS THE AIRCRAFT
C  POSITION AND ORIENTATION ASSOCIATED WITH THE CORRESPONDING VALUES IN
C  TGPL AND ALPL.  THE MEANINGS OF THE SECOND INDEX OF THIS ARRAY ARE:
C  1-X-COORDINATE IN FEET
C  2-Y-COORDINATE IN FEET
C  3-ANGLE IN RADIANS OF AIRCRAFT LONGITUDINAL AXIS WITH POSITIVE
C  X-AXIS.
C  TIHTSI COMMUNICATES WITH OTHER SUBROUTINES VIA THESE COMMON BLOCKS:
C  /AJIMIT/ - SEE FUNCTION SUBROUTINE AL.
C  /BJK2/ - CONTAINS THE DEGMENTED SPECIFICATION OF THE FLIGHT PATH.
C  ARRAY FLITEP IS FILLED BY SUBROUTINE OVRIAY
C  /VECBJK/ - CONTAINS VARIOUS VECTORS.
C  VR POINTS FROM THE FIXED COORDINATE ORIGIN TO THE AIRPLANE.
C  VALPHA, VBETA, VGAMMA ARE UNIT VECTORS POINTING IN THE DIRECTIONS OF
C   THE THREE AXES OF THE COORDINATE SYSTEM FIXED WITH THE AIRPLANE.
C  VD IS AN ARRAY OF VECTORS, EACH VECTOR POINTING FROM THE AIRPLANE TO
C  ONE OBSERVER.  VECTOR COMPONENTS ARE WITH RESPECT TO THE AIRPORT
C  FIXED COORDINATE SYSTEM.
C  VD2 IS THE SAME AS VD, BUT VECTOR COMPONENTS ARE WITH RESPECT TO THE
C  AIRPLANE FIXED COORDINATE SYSTEM.
C  THERE ARE THREE RETURNS POSSIBLE FROM TIHISI.  THE NORMAL RETURNS
C  OCCUR IN LINES 498 AND 502.  THE RETURN 1 IN LINE 554 IS TAKEN IN
C  CASE TIHISI DETECTS AN ERROR.  THE FOLLOWING IS A LIST OF TIHISI
C  ERROR MESSAGES:
C  TIHISI ERROR MESSAGES:
C  ERROR MESSAGES ARE IN THE FORMAT
C  ERROR IN TIHISI:  INDICATOR=XXX
C  WHERE XXX IS A SIGNED INTEGER NUMBER INDICATING THE KIND OF ERROR.
C  IF XXX IS:                    THE ERROR IS:
C  -1     ONE OF THE TIME LIMITS TMIN OR TMAX HAS BEEN REACHED.
C  0      AN ERROR IN THE SUBROUTINE OVRIAY WHICH WILL PRINT A MORE
C  EXPLICIT ERROR MESSAGE.
C  1      THE MAXIMUM NUMBER OF STEPS IN ONE SEGMENT (NSTEP) HAS BEEN
C  EXCEEDED.
C  2      NPTP BEING GREATER THAN 0, THE NUMBER OF TIME STEPS EXCEEDS
C  MPTP.
C  3      DURING THE EGA CALCULATION, IT IS DETERMINED THAT THE AIRCRAFT
C  ATTEMPTS TO FLY AT A NEGATIVE ATTITUDE.
C  4      NTH OUT OF RANGE.
C  5      MTS OUT OF RANGE.
C  6      NOBS OUT OF RANGE.
C  7      J OUT OF RANGE.
C  8      NSTEP IS LESS THAN 2.0 OR GREATER THAN 1000,000.
C  9      THE VALUES IN ARRAY AJTH ARE NOT MONTONICALLY INCREASING.
C  10     DINT<0.001 OR DINT> DMAXT.
C  11     DMINT<0.001 OR DMINT> DMAXT.
C  12     TMAX<TMIN.
C  13     DCL<0.000.
C  14     TSSC<1.001
C  15     OMEGA<0.001 OR OMEGA>3.
C  16     KTRAK<OR KTRAK>88.
C  17     MPTP>900.
C  18     ATTEMPT TO FLY PAST THE END OF THE DEFINED GROUND TRACK.
C  19     TL IS NOT EQUAL TO +1. OR -1.
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C  20    NPS IS OUT OF RANGE
C  21    BACKSP (IF CONVERTED TO DB) IS GREATER THAN ALTH(1)-1 IT
C  SHOULD BE NOTED THAT EXTENSIVE ERROR CHECKING IS DONE ONLY IF LCHECK
C  IS SET TO .TRUE. (SEE/THBLOK/).
C  TIHISI PROGRAM STRUCTURE AND PROCESSING PERFORMED:
C  LINES 1 THROUGH 28 (SEE LISTINGS, SECTION 5) ALL CONTAIN
C  SPECIFICATION STATEMENTS.  LINES 30 THROUGH 52 CHECK FOR
C  REASONABLENESS OF DATA SUPPLIED TO TIHISI.  IN LINE 57, THE PROFILE
C  AND THE GROUND TRACK ARE COMBINED ("OVERLAYED"), AND A SEGMENTED
C  FLIGHT PATH IS DEFINED.  LINES 62 THROUGH 175 PERFORM VARIOUS
C  INITIALIZATIONS AND ANCILLARY CALCULATIONS.  LINE 98 CONTAINS LABEL
C  801 WHICH IS A POINT TO WHICH CONTROL RETURNS AFTER EACH TIME STEP
C  (LINES 381, 497).  LABEL 812 (LINE 179) INCREASES THE REAL TIME,
C  I.E., PERFORMS THE DISCRETE TIME STEP, USING AN INTERNAL SUBROUTINE
C  DEFINED IN LINES 600 THROUGH 630.  IN LINE 190, THE AIRCRAFT
C  POSITION AND THE AIRCRAFT FIXED COORDINATE SYSTEM ARE DETERMINED.
C  IN LINES 208 THROUGH 231, THE MOMENTARY NOISE LEVEL AT EACH OF THE
C  NOBS OBSERVERS IS CALCULATED MAKING USE OF SUBROUTINES AI AND EGA.
C  NOTE THAT THE AIRCRAFT FIXED COORDINATE SYSTEM MUST BE USED WHEN
C  CALLING AI (LINE 223).  IN LINE 231, THE SOUND ARRIVAL TIME IS

C  CALCULATED USING A CONSTANT SPEED OF SOUND OF 1125 FEET PER SECOND.

C  VARIABLE TIME INCREMENT ALGORITHM

C  FOR AN AIRCRAFT NOISE TIME HISTORY IT IS DESIRABLE TO SPACE THE
C  POINTS ON THE TIME AXIS CLOSELY WHEN THE NOISE LEVEL CHANGES RAPIDLY
C  ,AND CONVERSELY, TO SPACE THE POINTS SPARSELY WHEN THE NOISE LEVEL
C  CHANGES SLOWLY.  THIS IS DONE IN AN EFFORT TO OBTAIN SUFFICIENT TIME
C  RESOLUTION WITHOUT REDUNDANT CALCULATIONS WHEN SUCH ACCURACY IS NOT
C  REQUIRED.  THE FOLLOWING OPERATIONAL PRINCIPLES ARE FOLLOWED IN
C  DETERMINING THE "NEXT" TIME INCREMENT DT:
C  ORDINARILY, DT IS INCREASED OR DECREASED FOR THE NEXT TIME STEP IN
C  INVERSE PROPORTION TO THE LAST NOISE LEVEL DIFFERENCE DL (SEE ALSO
C  DCT IN /ASDSBI/).
C  IF TWO SUCCESSIVE NOISE LEVEL DIFFERENCES ARE VERY SMALL, DT IS
C  DOUBLED.
C  IN ORDER TO INCREASE THE RESOLUTION, AN EXTRA POINT IS CALCULATED
C  HALF WAY BETWEEN THE PREVIOUS AND THE CURRENT TIME IF ONE OF TWO
C  CONDITIONS OCCURS: (1) DT IS EXCEPTIONALLY LARGE, AND (2) AN
C  EXTREMUM IS SUSPECTED, I.E., IF THE CURRENT AND THE PREVIOUS DL ARE
C  OF OPPOSITE SIGNS.  IF ONE OF THESE CONDITIONS OCCURS, THE LAST
C  CALCULATED RESULTS ARE DISCARDED AND THE PROCEDURE IS REPEATED USING
C  HALF THE STEP SIZE.
C  DT CAN NEVER BE LESS THAN DMINT OR GREATER THAN DMAXT.
C  THIS DETERMINATION OF THE "NEXT" TIME INCREMENT DT HAPPENS IN LINES
C  230 THROUGH 335.
C  MAKING USE OF AN INTERNAL SUBROUTINE (ASDT, LINES 550 THROUGH 591),
C  OKO CALCULATES NOISE LEVEL EXCEEDENCE TIMES OVER THRESHOLD LEVELS
C  USING SOUND ARRIVAL TIMES CALCULATED IN LINE 231.
C  IN LINES 358 THROUGH 497, VARIOUS CONDITIONS ARE CHECKED AND
C  DECISIONS ARE MADE REGARDING THE DIRECTION OF TIME PROGRESSION,
C  ADJUSTMENTS TO THE VARIABLE TIME INCREMENT, AND VALUES TO REMEMBER
C  FOR LATER CALCULATIONS.
C  TRACKING BEGINS AT THE POINT OF CLOSEST APPROACH TO THE FIRST
C  OBSERVER (PCA).  THE SEGMENT CONTAINING THIS POINT IS CALLED THE PCA
C  SEGMENT.  INITIALLY, A VARIABLE, JF, IS SET TO 3, INDICATING THAT,
C  STARTING AT TIME +=0 AT PCA, THE AIRCRAFT IS TRACKED IN A POSITIVE
C  TIME DIRECTION UNTIL THE END OF THE SEGMENT IS REACHED (POINT A).
C  RELEVANT PARAMETERS AT THIS POINT ARE STORED AND TRACKING CONTINUES
```

```
C  AT PCA PROGRESSING IN A NEGATIVE TIME DIRECTION (JF=2) UNTIL POINT B
C  IS REACHED.  AGAIN RELEVANT PARAMETERS ARE STORED, AND TRACKING
C  CONTINUES AT A WITH THE SEGMENT AFTER THE PCA SEGMENT (JF=1) UNTIL
C  THE NOISE LEVEL IS BELOW THE LOWEST THRESHOLD LEVEL, OVER AS MANY
C  SEGMENTS AS NECESSARY.  THEN, TRACKING RETURNS TO POINT B,
C  CONTINUING IN A NEGATIVE TIME DIRECTION AS FAR AS NECESSARY (JF=0).
C  NOTE THAT, NO MATTER WHAT THE TIME STEP SIZE, A CALCULATION OF NOISE
C  LEVELS AND SOUND ARRIVAL TIMES IS ALWAYS PERFORMED AT SEGMENT
C  BOUNDARIES, REDUCING THE CURRENT TIME STEP AS REQUIRED.  THE CODE IN
C  LINES 358 TO 497 IS COMPLICATED BECAUSE A NUMBER OF UNUSUAL
C  CONDITIONS CAN OCCUR WHICH MUST BE PROPERLY DEALT WITH.  FOR
C  INSTANCE, TRACKING MAY STOP ALREADY IN THE PCA SEGMENT.  OR, THE PCA
C  SEGMENT MAY BE THE FIRST SEGMENT (TAKEOFF OR LANDING ROLL).  ALSO,
C  FOR TAKEOFFS, THE AIRCRAFT'S NOSE IS POINTED IN THE POSITIVE TIME
C  DIRECTION.  FOR LANDINGS, THE TRACKING PROCEDURE IS IDENTICAL, ONLY
C  THE NOSE POINTS THE OTHER WAY.
C  BECAUSE THE TRACKING METHOD JUMPS BACK AND FORTH IN TIME, THE VALUES
C  DEPOSITED IN/PLOTBI/ ARE NOT IN PROPER ORDER.  IF USED, THEY MUST BE
C  SORTED ACCORDING TO MONOTONICALLY INCREASING SOUND ARRIVAL TIMES.
```

Subroutine TOLRD

```
      SUBROUTINE TOLRD
C
C     ******************************************************************
C  TOLRD - SUBROUTINE
C  THE SUBROUTINE TOLRD IS USED TO READ USER DEFINED REPLACEMENT VALUES
C  FOR THE TOLERANCE TO BE USED IN CHECKING FOR CONTOUR LOOPING
C  CONDITIONS.
C  TOLRD DOES NOT USE ANY EXTERNAL SUBROUTINES.
C  TOLRD HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS
C  CALL TOLRD
C  READIN IS THE ONLY SUBROUTINE TO CALL TOLRD AND IT WILL NORMALLY
C  ONLY BE CALLED ONCE PER RUN.
C  THE INPUT TO TOLRD IS PROVIDED FROM DATA CARDS IN THE INPUT RUN DECK
C  THERE IS ONE EXIT RETURN FROM TOLRD, LOCATED AT LINE NUMBER 11 IN
C  THE SUBROUTINE LISTING IN SECTION 5 AND IT IS ALWAYS USED.
C  THE OUTPUT FROM TOLRD IS THE MODIFIED VALUES FOR THE VARIABLES TOLLOP
C  AND TOLSIG IN LABELED COMMON BLOCK/BK/.  THE VARIABLE TOLLOP IS USED
C  IN CONTOUR LOOP CHECKING COMPUTATIONS.  THE VARIABLE TOLSIG IS NO
C  LONGER USED BY THE PROGRAM.
C
```

Subroutine TPLDT

```
      FUNCTION TPLDT (T,IGO,DT,TLAMAX,TLAMIN,JF,TMAX,TMIN,DMINT,LDMINT)
C
C     ******************************************************************
C      ADT - ABSOLUTE VALUE OF DT
C      DFTHMX- MAXIMUM ALLOWABLE THRUST CHANGE OVER THE NEXT TIME STEP.
C
C     DMINT- THE SMALLEST ALLOWABLE TIME STEP SIZE IN SECONDS
```

```
C      DT- THE NEXT TIME INCREMENT
C       IGO - ERROR RETURN
C       JF - INDICATES TIME DIRECTION OF PROGRESSION
C       IDEINT - IS ADT LESS THAN OR EQUAL DMINT
C       ITM - THE TIME LIMIT HASNT BEEN REACHED YET
C      STHC- SPEED WHEN CROSSING A SEGMENT BOUNDARY
C      T- TIME WHEN THE AIRCRAFT IS EXACTLY AT THE SEGMENT BOUNDARY
C       TLAMAX - MOST SUBSEQUENT TIME STEP TO BE CONSIDERED IN CURRENT SEG
C       TLAMIN - MOST PREVIOUS   TIME STEP TO BE CONSIDERED IN CURRENT SEG
C      TMAX- THE LARGEST ALLOWABLE REAL-TIME IN SECONDS
C      TMIN- THE SMALLEST ALLOWABLE REAL-TIME IN SECONDS
C       TPLDT - CURRENT TIME STEP (QUESTION MARK)
C
```

Subroutine TPROF

```
      SUBROUTINE TPROF (A2,A1,T2,T1,NP)
C
C     ******************************************************************
C     DELT - RATIO PRESSURE ALTITUDE CHANGE
C     DH - DIFFERENCE IN HEIGHT ABOVE RUNWAY FOR LIFTOFF- GEARUP SEGS
C     DIF - CHANGE IN PRESSURE ALT>RATIO INCREASE IN CLIMB GRADIENT
C     DS - DIFFERENCE IN PRESSURE ALTITUDE FOR LIFTOFF ETC
C     EW - AIRCRAFT POWER TO WEIGHT RATIO
C     GAMMA - CLIMB GRADIENT
C      JNT - INDICATES FORM OF PROFILE
C     NP - PROFILE NUMBER
C     PD1 - PRESSURE DIFFERENCE ACROSS FIRST PROFILE SEGMENT
C     PD2 - PDI CORRECTED FOR TEMP + PRESSURE ALT CHANGES
C     THETA - RATIO TEMPERATURE CHANGE
C     WT - AIRCRAFT WEIGHT
C  TPROF - SUBROUTINE
C  TPROF CORRECTS THE STORED AIRCRAFT TAKEOFF PERFORMANCE CHARACTER-
C  ISTICS FOR EFFECTS OF AIRPORT ALTITUDE (ABOVE MEAN SEA LEVEL) AND
C  AMBIENT TEMPERATURE.
C  TPROF CALLS THE SUBROUTINE DELTA.
C  TPROF HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS
C  CALL TPROF (A2,A1,T2,T1,NP)
C  WHERE
C  A2 - AIRPORT PRESSURE ALTITUDE
C  A1 - REFERENCE PRESSURE ALTITUDE
C  T2 - AMBIENT TEMPERATURE (K)
C  T1 - REFERENCE TEMPERATURE (K)
C  NP - PERFORMANCE PROFILE NUMBER
C  TPROF IS CALLED BY THE SUBROUTINES PROFRD AND RWYRD AND MAY BE
C  CALLED MANY TIMES DURING THE INPUT PHASE OF EXECUTION.
C  THE INPUT TO TPROF IS PROVIDED BY THE CALLING ARGUMENTS AND THE
C  VARIABLE PROF IN THE LABELED COMMON BLOCK/PROFIL/.
C  THERE ARE FOUR EXIT RETURNS FROM TPROF, LOCATED AT LINES NUMBERED 15
C  16, 31, AND 73 IN THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN
C  AT LINE 15 IS USED IF THE PROFILE NUMBER IS GREATER THAN 99 AND THE
C  RETURN AT LINE 16 IS USED IF THE PROFILE HAS NOT BEEN DEFINED.  THE
C  RETURN AT LINE 31 IS USED IF THE PROFILE IS NOT IN THE PROPER FORM.
C  THE RETURN AT LINE 83 IS USED AFTER PROFILE NP HAS BEEN MODIFIED.
C  THE OUTPUT FROM TPROF CONSISTS OF THE MODIFIED VALUES FOR THE NPTH
C  PROFILE VARIABLE PROF.
C
```

Subroutine VADD

```
      SUBROUTINE VADD (C,A,B)
C
C     ******************************************************************
C  VADD - SUBROUTINE
C  VADD IS A VECTOR ADDITION SUBROUTINE.  TWO GIVEN VECTORS ARE ADDED
C  FORMING A THIRD VECTOR.
C  VADD DOES NOT USE ANY EXTERNAL SUBROUTINES.
C  VADD HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS
C  CALL VADD(C,A,B,)
C  WHERE
C  C - VARIABLE OF DIMENSION2 OR MORE TO RECEIVE THE SUM OF VALUES IN A
C  AND B
C  A - VARIABLE OF DIMENSION2 OR MORE CONTAINING VALUES TO BE ADDED TO
C  B
C  B - VARIABLE OF DIMENSION2 OR MARE CONTAINING VALUES TO BE ADDED TO
C  A
C  VADD IS CALLED BY THE SUBROUTINES NWASDS, STRAIT, XLINE AND THE MAIN
C  PROGRAM NOISE1.  VADD WILL BE CALLED MANY TIMES DURING EXECUTION.
C  THE INPUT DATA FOR VADD IS PASSED THROUGH THE CALLING ARGUMENTS.
C  THERE IS ONE EXIT RETURN FROM VADD AND IS ALWAYS USED.
C  THE OUTPUT FROM VADD IS PASSED THROUGH THE CALLING ARGUMENTS.
C
```

Subroutine VDOT

```
      FUNCTION VDOT (A,B)
C     ******************************************************************
C  VDOT - FUNCTION SUBROUTINE
C  VDOT RETURNS THE "DOT PRODUCT" OF TWO GIVEN VECTORS.
C  VDOT DOES NOT USE EXTERNAL SUBROUTINES.
C  VDOT HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS
C  VDOT(A,B)
C  WHERE
C  A,B - VARIABLES OF DIMENSION2 OR MORE
C  VDOT IS CALLED BY THE SUBROUTINES VMAG, STRAIT, NEQPNT AND CKLOOP.
C  IT WILL BE CALLED MANY TIMES DURING EXECUTION.
C  THE INPUT TO VDOT IS THROUGH THE CALLING ARGUMENTS.
C  THERE IS ONE EXIT RETURN FROM VDOT AND IT IS ALWAYS USED.
C  THE OUTPUT FROM VDOT IS PASSED TO THE CALLING PROGRAM BY THE
C  FUNCTION NAME.
C
```

Subroutine VMAG

```
      FUNCTION VMAG (A)
C
C     ******************************************************************
C  2.5E  VMAG - FUNCTION SUBROUTINE
C  VMAG RETURNS THE MAGNITUDE OF A GIVEN VECTOR.

C  VMAG CALLS THE SUBROUTINE VDOT.
```

```
C  VMAG HAS ON ENTRY POINT AND THE CALLING SEQUENCE IS
C  VMAG(A)
C  WHERE
C  A - VARIABLE OF DIMENSION OR MORE
C  VMAG IS CALLED BY THE SUBROUTINES STRAIT, HBT, TWYRD, VONT, FIRST,
C  NEWPNT, GRADTE, CKLOOP, NWASDS, CURVE, AND THE MAIN PROGRAM NOISE1.
C  THE INPUT TO VMAG IS THE CALLING ARGUMENT.
C  THERE IS ONE EXIT RETURN FORM VMAG AND IT IS ALWAYS USED.
C  THE OUTPUT OF VMAG IS PASSED TO THE CALLING PROGRAM BY THE FUNCTION
C  NAME.
C
```

Subroutine VSCL

```
      SUBROUTINE VSCL (C,F,A)
C
C     ******************************************************************
C  2.65  VSCL - SUBROUTINE
C  VSCL MULTIPLIES A GIVEN VECTOR BY A GIVEN SCALAR.
C  VSCL DOES NOT USE ANY EXTERNAL SUBROUTINE.
C  VSCL HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS
C  CALL VSCL(C,F,A,)
C  WHERE
C  C,A - VARIABLES OF DIMENSION2 OR MORE
C  F - MULTIPLIER
C  VSCL IS CALLED BY THE SUBROUTINES NWASDS, STRAIT, XLINE AND THE MAIN
C  PROGRAM NOISE1.
C  THE INPUT TO VSCL IS PROVIDED BY THE CALLING ARGUMENTS.
C  THERE IS ONE EXIT RETURN FORM VSCL AND IT IS ALWAYS USED.
C  THE OUTPUT FROM VSCL IS PASSED THROUGH THE CALLING ARGUMENTS.
C
```

Subroutine VSUB

```
      SUBROUTINE VSUB (C,A,B)
C
C     ******************************************************************
C  2.66  VSUB - SUBROUTINE
C  VSUB SUBTRACTS ONE VECTOR FROM ANOTHER.
C  VSUB DOES NOT USE ANY EXTERNAL SUBROUTINES.
C  VSUB HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS
C  CALL VSUB(C,A,B)
C  WHERE
C  C,A,B - VARIABLES OF DIMENSION2 OR MORE
C  VSUB IS CALLED BY THE SUBROUTINES CURVE, FIRST, HBT, NEWPNT, NWASDS,
C  TWYRD, STRAIT AND THE MAIN PROGRAM NOISE1.
C  THE INPUT TO VSUB IS THROUGH THE CALLING ARGUMENTS.
C  THERE IS ONE EXIT RETURN FROM VSUB AND IT IS ALWAYS USED.
C  THE OUTPUT FROM VSUB IS PASSED THROUGH THE CALLING ARGUMENTS.
C
```

Subroutine VTRN

```
      SUBROUTINE VTRN (C,A)
C
C     ******************************************************************
C  VTRN - SUBROUTINE
C  RTRN TRANSFERS A GIVEN VECTOR DEFINITION TO A SPECIFIED ALTERNATE
C  DEFINITION.
C  VTRN DOES NOT USE ANY EXTERNAL SUBROUTINES
C  THERE IS ONE ENTRY TO VTRN AND THE CALLING SEQUENCE IS
C  CALL VTRN(C,A)
C  WHERE C,A - VARIABLES OF DIMENSION3 OR MORE
C  VTRN IS CALLED BY THE SUBROUTINES FIRST, GRADIE, NEWPNT, NWASDS,
C  XLINE AND THE MAIN PROGRAM MCISE1.
C  THE INPUT TO VTRN IS THROUGH THE CALLING ARGUMENTS.
C  THERE IS ONE EXIT RETRN FROM VTRN AND IT IS ALWAYS USED.
C  THE OUTPUT FROM VTRN IS PASSED THROUGH THE CALLING ARGUMENTS.
C
      ..
```

Subroutine VUNT

```
      SUBROUTINE VUNT (C,A)

C

C     ******************************************************************

C  VUNT - SUBROUTINE

C  VUNT COMPUTES THE UNIT VECTOR CORRESPONDING TO A GIVEN VECTOR.
C  VUNT USES THE SUBROUTINE VMAG.
C  VUNT HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS
C  CALL VUNT(C,A)
C  WHERE
C  C,A - VARIABLES OF DIMENSION3 OR MORE
C  VUNT IS CALLED BY THE SUBROUTINES FIRST, NEWPNT, TRAKRD AND XLINE.
C  THE INPUT TO VUNT IS THROUGH THE CALLING ARGUMENTS.
C  THERE ARE TWO EXIT RETURNS FROM VUNT, LOCATED AT LINES 9 AND 12 IN
C  THE SUBROUTINE LISTING IN SECTION 5.  THE RETURN AT LINE 9 IS THE
C  NORMAL RETURN WHILE THE RETURN AT LINE 12 IS USED IF ALL VALUES OF A
C  ARE EQUAL TO ZERO.
C  THE OUTPUT FROM VUNT IS PASSED THROUGH THE CALLING ARGUMENTS.
C
```

Subroutine XLINE

```
      SUBROUTINE XLINE (KXX,NSX,XLX,UNIT,XP1)
C
C     ******************************************************************
C      LOCAL VARIABLE DICTIONARY
C     KXX - PARAM ARG
C     NSX - PARAM ARG
C      PARAM - (SEE DISCUSSION IN HBT) TRACK SEGMENT INFORMATION
C      UNIT - UNIT VECTOR IN DIRECTION OF SEGMENT
C     V - SEEMS IDENTICAL TO UNIT )IS CONVERTED TO UNIT
C     XLX - SEGMENT LENGTH
C     XP1 - UNIT VECTOR IN DIRECTION OF TRACK
```

```
C     VECTOR ANYWAY AS ERROR PREVENTION(
C   XLINE - SUBROUTINE
C   XLINE COMPUTES THE VARIABLES FOR THE STRAIGHT LINE SEGMENTS IN TRACK
C   DEFINITION DATA.  (SEE SUBROUTINE HRT, VARIABLE PARAM.)
C   XLINE USES THE SUBROUTINES VADD, VSCL, VTRN AND VUNT.
C   XLINE HAS ONE ENTRY POINT AND THE CALLING SEQUENCE IS:
C   CALL XLINE(KXX,NSX,XLX,UNIT,XR1)
C   WHERE
C   KXX - THE TRACK NUMBER
C   NSX - THE NUMBER OF THIS SEGMENT
C   XLX - THE LENGTH OF THE SEGMENT IN FEET
C   UNIT - A UNIT VECTOR TANGENT TO THE END POINT (NOT THE START POINT)
C   OF THE LAST SEGMENT.  UNIT IS OF DIMENSION3 OR MORE, THE FIRST TWO
C   POSITIONS OF WHICH CONTAIN THE VALUES OF THE X- AND Y-COMPONENTS OF
C   THE UNIT VECTOR.
C   XR1 - A VARIABLE OF DIMENSION2 OR MORE, THE FIRST TWO POSITIONS OF
C   WHICH CONTAIN THE X- AND Y-COORDINATES OF THE END POINT OF THE LAST
C   SEGMENT.
C   THE ONLY SUBROUTINE TO USE XLINE IS TRAKRD.  XLINE IS USED IN
C   CONJUNCTION WITH HELG TO DEFINE GROUND TRACK GEOMETRY AND MAY BE
C   USED MANY TIMES DURING THE INPUT PHASE OF EXECUTION.
C   THERE IS ONE EXIT RETURN FROM XLINE, LOCATED AT LINE NUMBER 15 IN
C   THE LISTING OF THE SUBROUTINE IN SECTION 5.  THIS RETURN IS ALWAYS
C   USED.
C   THE OUTPUT FROM XLINE IS PASSED THROUGH THE CALLING ARGUMENTS.  IN
C   ADDITION, THE APPROPRIATE LOCATIONS IN THE VARIABLE PARAM IN LABELED
C   COMMON BLOCK/TRACK/ ARE INITIALIZED.
C   THE ONLY PROCESSING PERFORMED BY XLINE IS THE COMPUTATION OF THE END
C   POINT OF THE SEGMENT SINCE THE START POINT IS IDENTICAL TO THE END
C   POINT OF THE LAST SEGMENT.
C   XS,YS - SEGMENT START COORDINATES
C   XU,YU - COMPONENTS OF UNIT VECTOR ALONG THE SEGMENT
C   XLX - SEGMENT LENGTH
C
```

Subroutine ZERO

```
      SUBROUTINE ZERO (A,N)
C
C     ********************************************************************
C      A - VECTOR TO BE CLEARED
C     N - NUMBER OF ELEMENTS IN VECTOR A
C   ZERO - SUBROUTINE
C   ZERO SETS SPECIFIED MEMORY LOCATIONS TO THE NUMERIC VALUE ZERO.
C   ZERO DOES NOT USE ANY EXTERNAL SUBROUTINES.
C   ZERO HAS ONE ENTRY POINT AD THE CALLING SEQUENCE IS:
C   CALL ZERO(A,N)
C   WHERE
C   A - VARIABLE OF ANY DIMENSION
C   N - NUMBER OF POSITIONS IN A TO BE SET TO ZERO.
C   ZERO IS CALLED BY THE SUBROUTINES CLRTAL, DMPTAL, EXPOSE, PCNTRD AND
C   THE MAIN PROGRAM NOISE1.
C   THE INPUT TO ZERO IS THROUGH THE CALLING ARGUMENTS.
C   THERE IS ONE EXIT RETURN FROM ZERO AND IT IS ALWAYS USED.
C   THE OUTPUT FROM ZERO IS THROUGH THE CALLING ARGUMENTS.
C
```